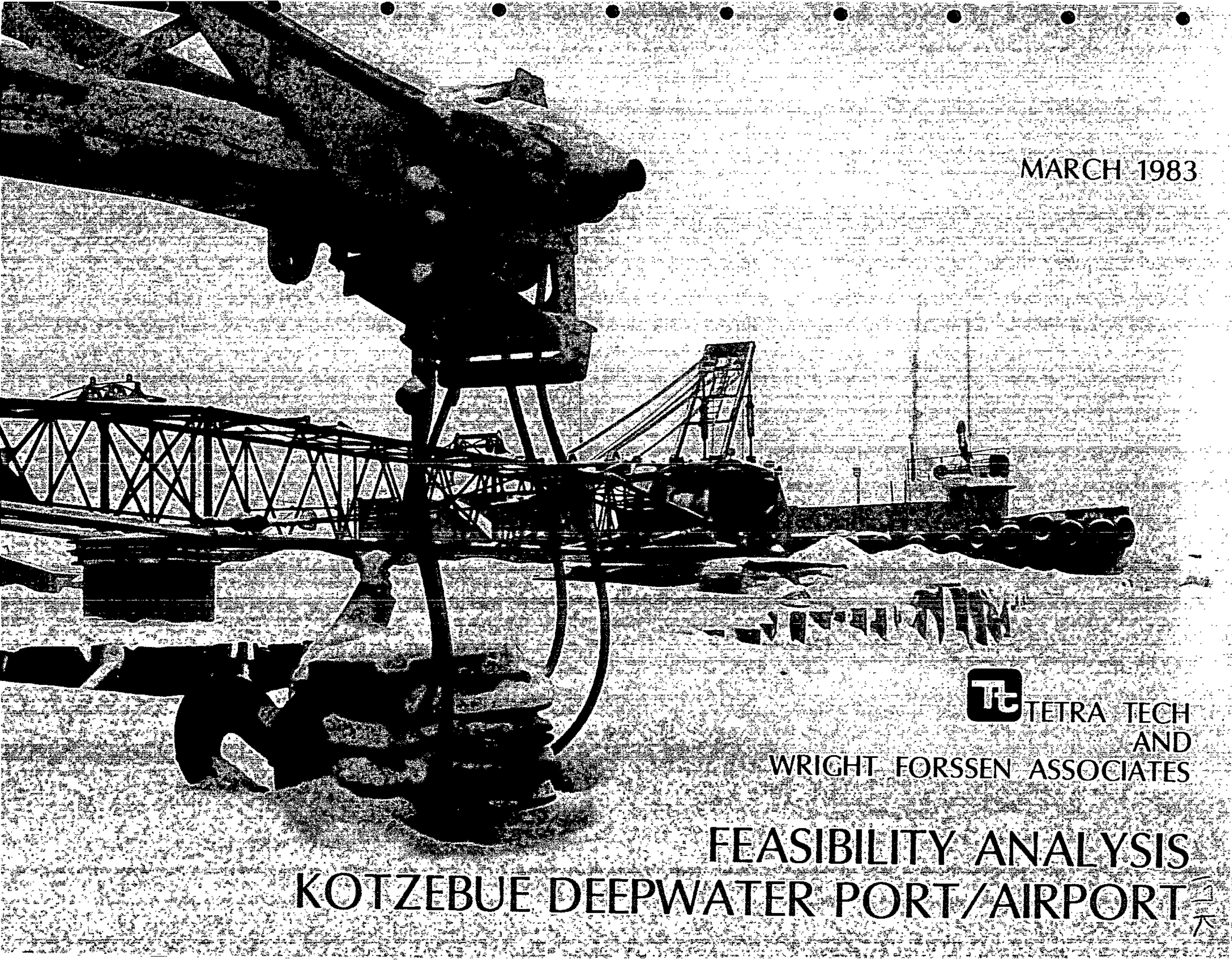


MARCH 1983

TETRA TECH
AND
WRIGHT FORSSEN ASSOCIATES

FEASIBILITY ANALYSIS
KOTZEBUE DEEPWATER PORT/AIRPORT

TETRA TECH/WRIGHT FORSSEN ROBERTSON
Kotzebue Port/Airport Project Office
2550 Denali St., Suite 601
Anchorage, Alaska 99503-2775
Tel. 907/279-6651 Telex: 26-315

March 25, 1983

City of Kotzebue
P.O. Box 46
Kotzebue, Alaska 99752

Attention: Mr. Gene Moore, City Manager

Subject: Final Report
Kotzebue Deepwater Port/Airport Feasibility Study

Gentlemen:

We are pleased to submit 25 copies of the Final Report for the Deepwater Port and Airport Feasibility Study. The report combines both draft reports previously submitted, and reflects comments received from the City of Kotzebue, NANA, and the State of Alaska. An Executive Summary is included in the Final Report. Additionally, 25 copies of separately bound Executive Summaries are submitted.

The report presents our recommendations and estimated costs for phased development of a deepwater port for Kotzebue, to be located at cape Blossom.

It has been a pleasure to perform this study for the City, and we look forward to the opportunity of working with you on the detailed design and development of this worthwhile project.

Very truly yours,

TETRA TECH, INC.
WRIGHT FORSSEN ASSOCIATES

Guido Zemgals
Project Manager

TABLE OF CONTENTS

Section [redacted]

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

Section

APPENDICES

LIST OF PHOTOS

Photo [redacted]

LIST OF FIGURES

Figure [redacted]

LIST OF FIGURES (Cont'd)

LIST OF TABLES

LIST OF TABLES (Cont'd)

EXECUTIVE SUMMARY

The Kotzebue Deepwater Port/Airport analysis was undertaken to determine the feasibility of developing a deepwater port and related facilities, including an airport, to serve projected shipping increases within the northwest Alaska region served by Kotzebue (see Figure 1).

The study followed a sequential approach based on tasks outlined by the City of Kotzebue in its Scope of Work:

- o Task 1 included data collection and development of a detailed work plan. Local public input was included.
- o Task 2 was site inventory and analysis. Alternative sites for the deepwater port and related facilities were researched and compared to determine the best potential development site.
- o Task 3 was the planning and preliminary engineering phase. Siting conclusions were subjected to further planning analysis. Preliminary engineering and cost estimates were performed for the recommended port development.
- o Task 4 was an economic analysis of the proposed work. This included financial resource studies, capital benefit projections, and economic impact predictions.

Tasks 1 and 2 were summarized in a draft report submitted to the City of Kotzebue in July, 1982. A public meeting was held the previous month to report study progress and acquire input for siting analyses.

Tasks 3 and 4 were summarized in a draft report submitted to the City of Kotzebue and presented at a public meeting in December, 1982. Comments received from subsequent review of the report were analyzed and included in this Final Report.

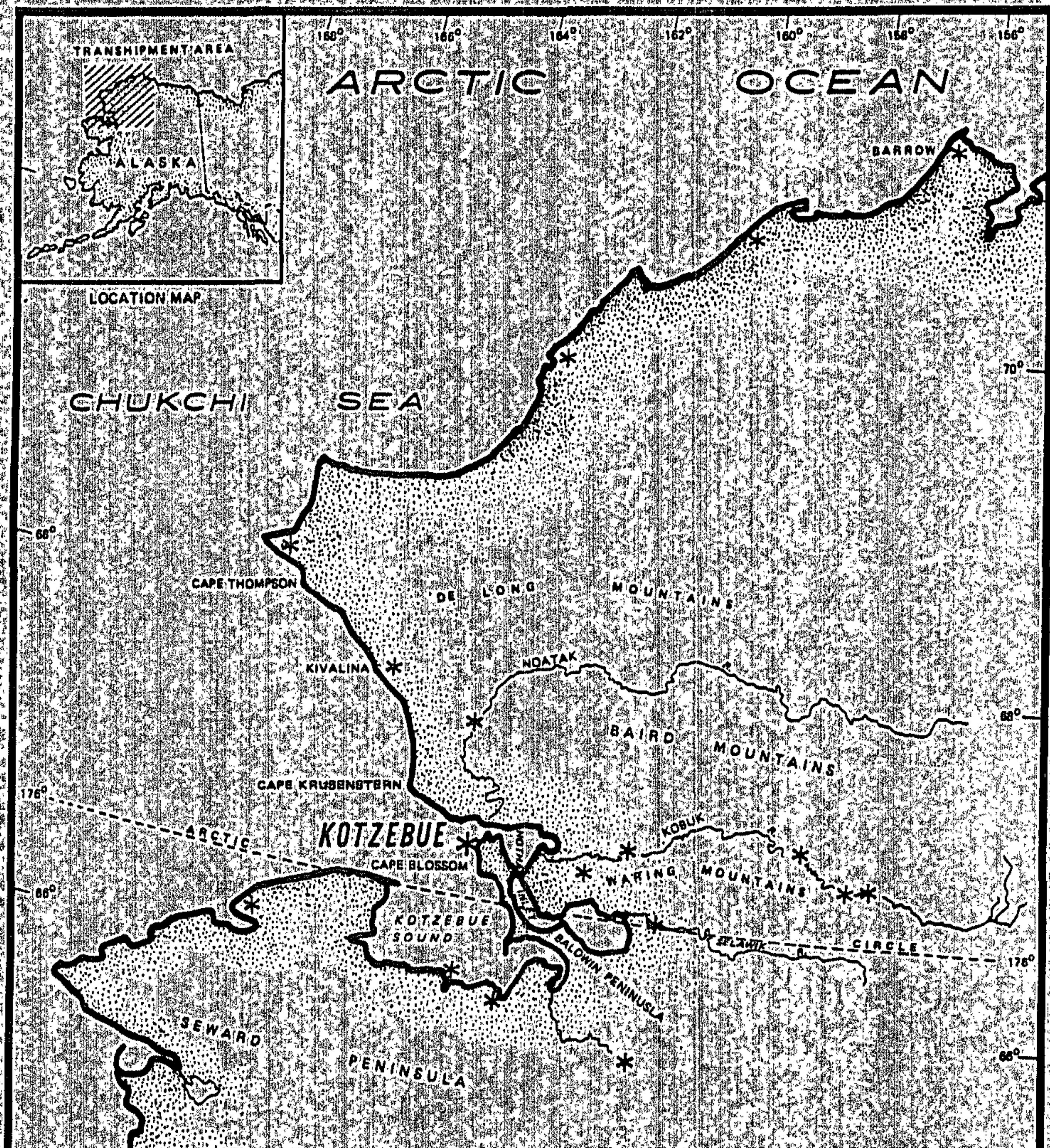


FIGURE 1 LOCATION MAP

The final report presents the results of the entire study, summarizing all the siting, planning, and preliminary engineering efforts. An economic analysis including possible financing techniques is also presented. The probable effects of an expected port development near Kivalina are considered when analyzing the future Kotzebue port.

Siting Determinations

The study initially focused on background information pertaining to the physical, biological, and human environments. Current port and airport operations and future needs were analyzed to formulate new port and airport design criteria. Several sites for potential development were then examined; three sites were selected for more detailed analysis: the existing City site; a site at Cape Blossom, 12 miles south of Kotzebue; and the Isthmus site, located 24 miles southeast of Kotzebue (see Figure 2).

Detailed information was gathered for these sites and all were then compared to design criteria. This process clearly demonstrated that the Cape Blossom site is the best location for deepwater port development. It is located in reasonable proximity to the City, and deep water is available only 4,000 feet offshore, as opposed to 6,000 feet at the Isthmus and 13 miles at the City. Adequate land is available for initial port and airport development at Cape Blossom, with substantial additional space for future landside expansion.

Over the near future, airport passenger operations can best be served by the existing airport, although a cargo strip at Cape Blossom could be advantageous. Waterborne transshipment service from the port or airport to the hinterlands can be readily handled at the existing City Dock.

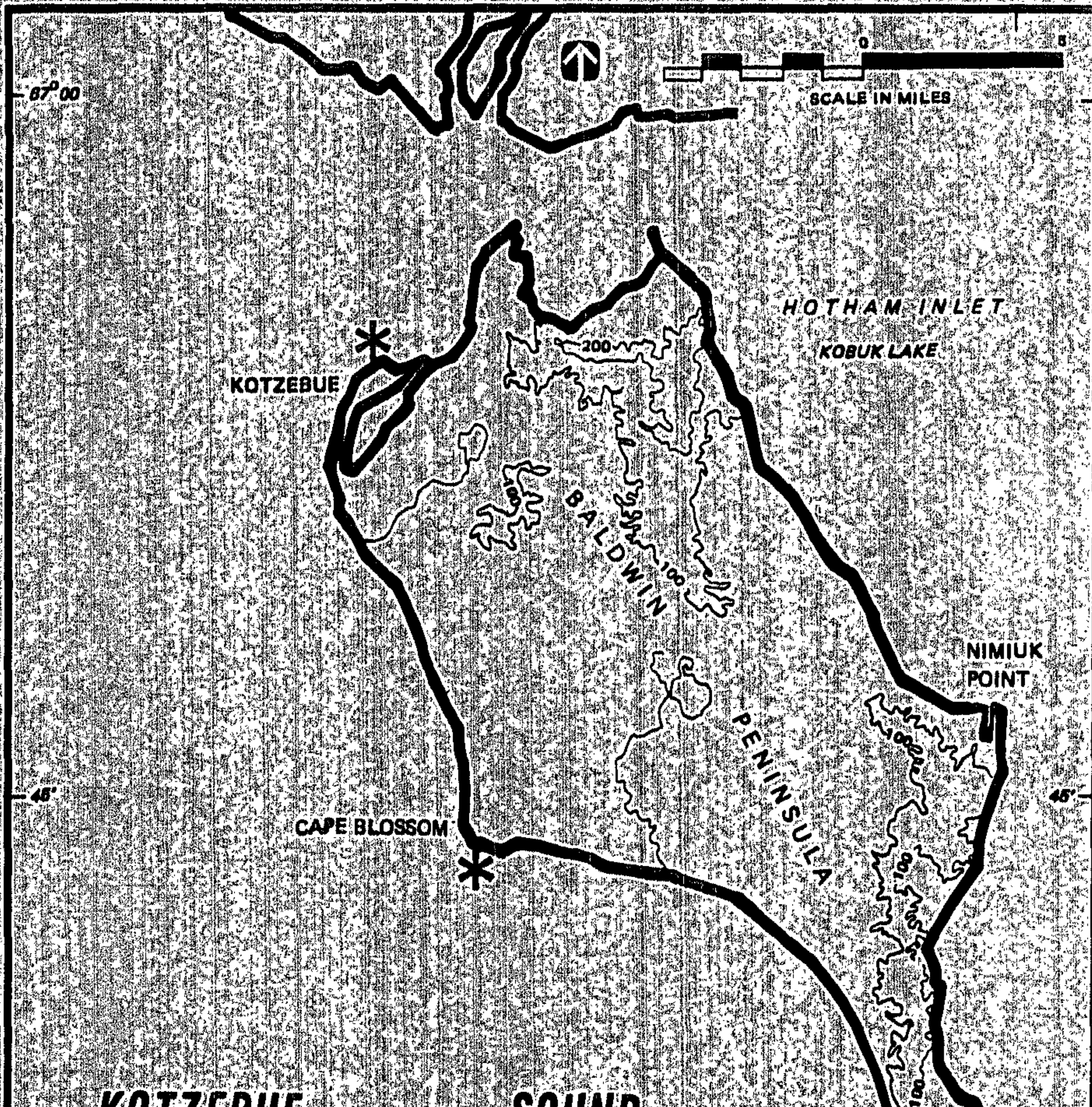


FIGURE 2 POTENTIAL DEEPWATER PORT SITES FOR KOTZEBUE

A separately proposed port to serve mining operations near Kivalina is not expected to affect the need for Kotzebue's deepwater port, primarily because no convenient land routes are possible between Kivalina and Kotzebue.

Once the site for port development was determined, planning and preliminary engineering activities began. After examining several alternatives for port design, a phased approach was developed.

Conceptual Port Plan

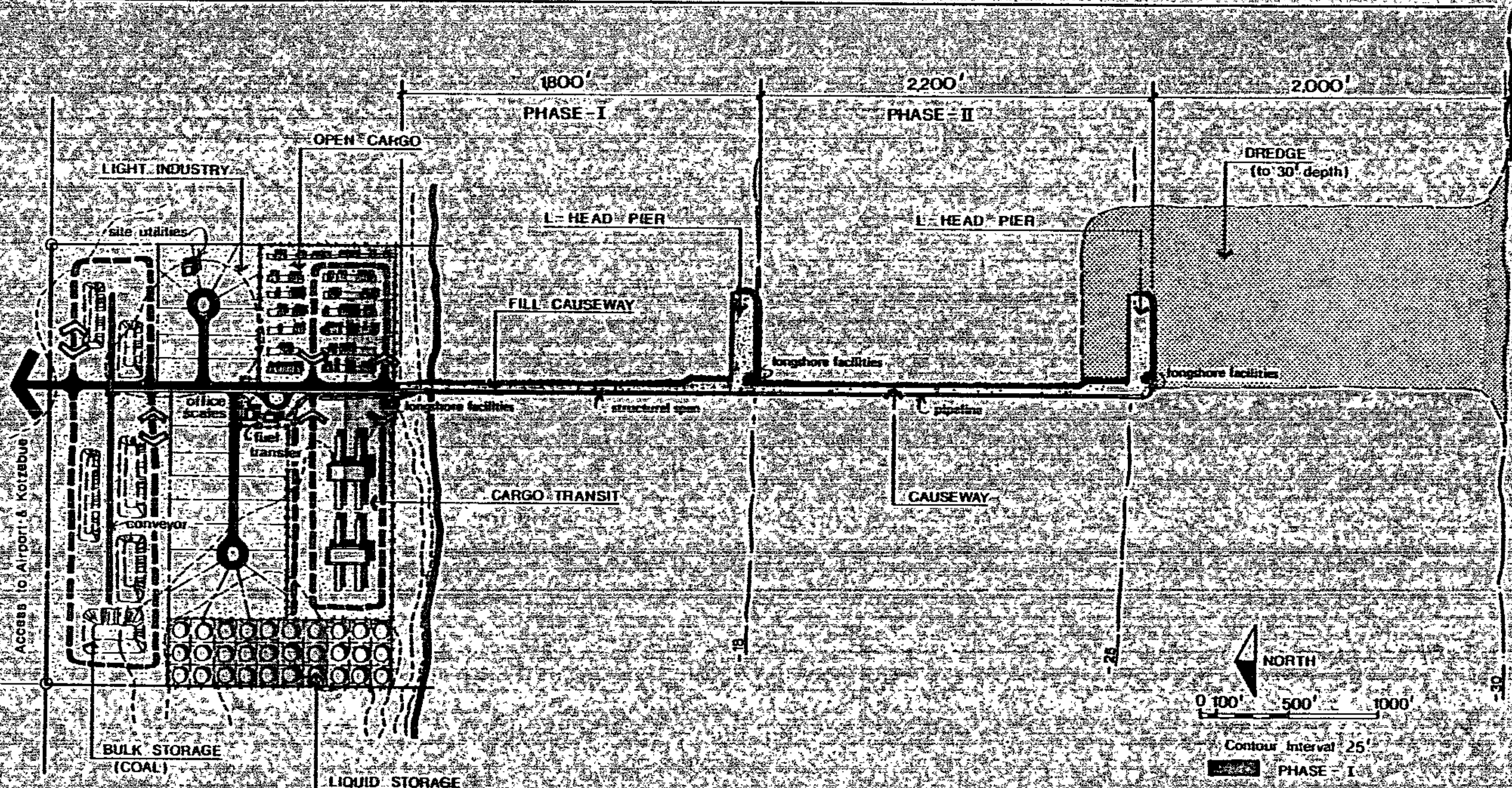
The new deepwater port at Cape Blossom is recommended for development in two phases (see Figure 3).

Phase I would include a 120 foot x 600 foot L-head pier located 1,800 feet offshore in 18 feet of water. The pier would be connected to the shore by a fill causeway, with the roadway at an elevation of 15 feet above MeanLower-Low-Water (MLLW). One structural causeway span would be required, constructed of pre-cast, prestressed concrete bulb tees 150 feet long supported on concrete abutments constructed on the causeway. This span would allow unobstructed open water for migrating fish. This facility could accommodate present shipping needs and support offshore petroleum exploration.

Phase II would extend the causeway 2,200 feet from the inner pier to a second L-head pier. The pier would be in 25 feet of water. To allow docking of even deeper draft vessels, dredging could increase water depths to 30 feet. Phase II construction could be triggered by the expected coal mining operations at Chicago Creek or by offshore petroleum development in the Chukchi Sea/Hope Basin. The resulting increase in shipping would require additional port development to handle coal and mineral export.

DEEPWATER PORT FACILITES

FIGURE 1



TETRA TECH/ WRIGHT FORSSEN ASSOCIATE

Alternatively, an unphased development would provide a 4,000 foot-long rubble-mound causeway to a single L-head pier in 25 feet of water. This apparently would be inferior because construction expenditures would not occur in phase with demonstrated needs.

Recommended development of on-shore support facilities at Cape Blossom would also proceed sequentially, and port operations would gradually be relocated from Kotzebue to Cape Blossom. Initially, a tank farm would be constructed at Cape Blossom, with pipelines or tanker trucks used to move fuel to smaller supply tanks at a relocated tank farm near Kotzebue. A 12,000 square foot transit building would be constructed at Cape Blossom for temporary storage of dry cargo bound for Kotzebue or for transshipment from Kotzebue to river villages and other hinterland destinations. Necessary utilities and outside secured storage would also be provided at Cape Blossom to accommodate weatherproof containers, equipment, and construction materials. A spur road would be built from the new port at Cape Blossom to the planned Kotzebue-Chicago Creek Road.

Land facilities at Cape Blossom would be further expanded during Phase II development, and a conveyor system to load and unload vessels would be provided. All administrative functions for the new port would be relocated to Cape Blossom; only the transshipment function would remain at the City Dock.

Port Economics

Costs. Cost estimates were made without the benefit of specific geotechnical investigations, and assume the availability of suitable armor rock at Cape Nome. Components of the cost projections are shown on the following page.

TABLE 1

KOTZEBUE DEEPWATER PORT
OFFSHORE CONSTRUCTION COSTS

Phase I pier and causeway....................	$34,861,000
Phase II pier and extended causeway........	$51,458,000
Total Offshore Cost..........................	$86,319,000

On-shore development total costs, estimated at $14,932,000 depend upon level of economic development. If a pipeline, rather than truck haul, is used to transfer fuels from Cape Blossom to Kotzebue, the estimated cost of such a system is $14 million.

Economic Feasibility. Revenue projections for the port, which would be collected as terminal tariffs, are not expected to be of a level that would allow recovery of total development costs, unless significant mining export development or oil exploration and development occurs. Such development would substantially increase port throughput and projected revenues.

Without mineral exports, maximum capital investment that could be justified by projected annual direct port revenues, less operations and maintenance expenses, is about $9 million. Since port development would eliminate ocean vessel delay due to lightering operations, further cost savings would be generated. These savings would justify another $3.7 million in capital investment for a total investment of $12.7 million. If more shipping develops, or if fees are increased, port revenues and returns on investment would increase accordingly.

Socio-Economic Implications. During the construction period, the proposed project would increase short-term employment substantially, and local business revenues and public revenues would increase. Over the long term, economic development would be encouraged by the larger port, and population would increase.

The gradual phasing out of operations at Kotzebue and relocation of the hazardous tank farm would make vacated land and buildings available for other needs. This could prove to be of benefit to the community and could reduce land use conflicts in the area. Some businesses would be expected to relocate to the new Cape Blossom site, as port facilities are built and infrastructure is developed.

Kivalina Mining Port. It is probable that a port will be developed near Kivalina to serve Red Dog mining operations before a general cargo port can be developed near Kotzebue. As presently envisioned, however, the Kivalina port will be rather self-contained and impacts on the proposed Cape Blossom port will be slight. The principal effect will be to stimulate the economy at Kotzebue and possibly increase throughput over time.

A possible option under consideration by the mine development company is to make lightering barges available for coastwise service to Kotzebue, when they are not actually transferring ore to deepwater carriers. Proposed barges would be about 7,500 DWT and could berth at the existing port. Two such barges and two tugs would be available for about 50 of the possible shipping days. This option would no longer exist after 5 years due to project needs at Kivalina.

Airport Development

A slightly different set of factors would govern development of the recommended cargo airport at Cape Blossom. The need for increased air cargo operations would be initiated principally by increased oil exploration and development activities in the Chukchi Sea. However, provisions for eventual airport development should be considered concurrently with land acquisition for port development. This is necessary because port development probably would induce substantial increases in adjacent land values.

If Outer Continental Shelf (OCS) oil exploration materializes as expected, an airport designed to handle general cargo transport could be constructed adjacent to the deepwater port site at Cape Blossom. It would be designed to be expandable to serve expected future needs. A 6,400 foot east-west runway, sufficient to handle Boeing 737-200 and Lockheed Hercules (C-130) aircraft would be provided. Minimum support facilities would include necessary taxiways, apron and parking areas and a terminal/storage building. Passenger service would continue at the existing Kotzebue airport unless a decision is made to remove all operations to the new site and abandon the present airport.

Because of the proximity and capability of the existing airport and the focus of this study on port development, no detailed cost estimates or economic analyses relative to the airport are attempted. This is not to say that there are not major benefits in relocating the airport, or in developing an industrial airport.

Conclusions and Recommendations

The existing port at Kotzebue is inadequate because of its shallow water depths and limited space for expansion. Increased mining and oil exploration activities in the region will overtax existing facilities, further increasing shipping delays and costs.

A new deepwater port is needed. It is recommended that the new port be built in two phases at Cape Blossom.

Phase I development would satisfy current shipping needs for Kotzebue and projected needs for offshore petroleum exploration. Phase II development, extension of the causeway to a second pier in deeper water, probably would be triggered by coal export operations from the proposed Chicago Creek Mine. Phase I offshore development is estimated to cost approximately $34.9 million, and Phase II is estimated to cost about $51.5 million. Both costs reflect an assumed solid fill causeway with armor stone protection.

On-shore support development should also be provided in phases, to coincide with the port development program and increases in shipping. Port operation should be gradually transferred from Kotzebue to Cape Blossom, with only a small transshipment facility remaining at the Kotzebue dock for service to the hinterlands. Total cost of on-shore development is estimated at $14.9 million.

Airport development at Cape Blossom should be considered as OCS oil exploration and onshore mineral development materialize and air support requirements increase. At that time, airport proximity to the port may be desirable to avoid truck traffic through the city. An additional impetus for development of a Cape Blossom airport may come from future needs to improve overall aviation operations and to create better access between the city and areas lying directly south of the existing airport.

INTRODUCTION

1.0 BACKGROUND

The City of Kotzebue is called the "Gateway to Northwest Alaska." Populations and industries throughout this region rely upon Kotzebue as a transportation hub (see Figure A-1.1). Nearly all regional supplies arrive at Kotzebue by ocean shipments between June and September. The remaining supplies and virtually all interregional passenger travel require air transportation. There are no roads or railroads to Kotzebue or the region it. serves.

Since waters of Kotzebue Sound are shallow, ocean-going barges are forced to anchor far offshore. Shipments then are lightered onto shallow-draft barges and brought to the existing port located within developed areas of Kotzebue. The cost of goods received in the Northwest Region of Alaska is increased significantly by the lightering operations. Additionally, land availability at the port is limited, creating storage problems and precluding port expansion for new requirements. such as exports and industrial staging.

Air transportation also is essential to Kotzebue and the region it serves. Northwest Alaska is remote to goods and service centers of the state, and ocean freezup eliminates ship arrivals during most of the year. The Kotzebue airport experiences problems very similar to the port. Surrounding land uses generally limit airport expansion, and airport facilities appear to be inadequate for needs in the very near future.

The distribution of goods and services to surrounding villages occurs largely by small barges and boats traversing regional river systems. Most of these rivers empty into Kobuk Lake (Holtham Inlet). A port improvement project at

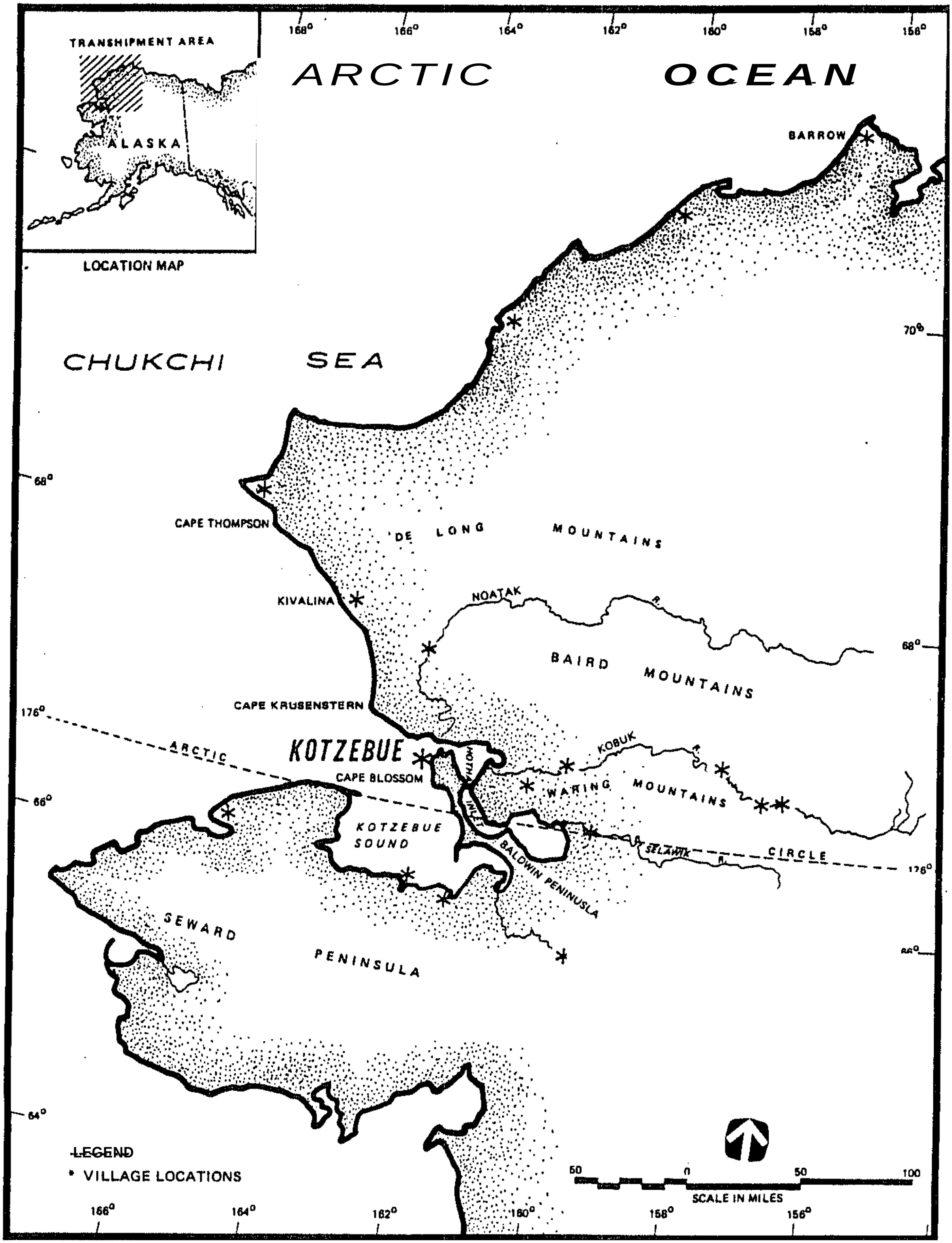


FIGURE A-I.I LOCATION MAP

Kotzebue offers potential opportunities to concurrently provide a transshipment subport on Kobuk Lake, especially if the port is relocated south of the city at a narrower portion of Baldwin Peninsula. Likewise, airport relocation adjacent to a new port site generates potential advantages which deserve evaluation.

The impetus to begin planning and engineering for a deepwater port and other regional transportation facilities at Kotzebue largely is derived from impending mineral and petroleum developments within the Northwest Region of Alaska. Deepwater port implementation is required to serve future mining exports and to handle increased demands of growing populations and industries.

2.0 STUDY APPROACH

The two principal objectives of this study are (1) to determine the overall feasibility of developing a deepwater port and transshipment port at Kotzebue and (2) to ascertain the feasibility of siting an airport near the deepwater port. Each of these objectives involves multiple task accomplishments.

A site selection phase is required for initial feasibility evaluation. This phase is accomplished by analyzing pertinent existing conditions within the region, determining specific siting requirements for both port and airport facilities, and then comparing the relative merits of each alternative site. The siting analysis for the port facility is more detailed than the airport facility because port development is selected as the primary goal of this study.

The site selection phase is followed by a planning and preliminary engineering phase. First, potential expansion plans for the existing port and airport are compared to the relocation plans devised during site analyses. From this comparison, final site selections are determined. Conceptual plans then are developed for the selected port and airport sites. These conceptual plans are used to estimate construction and operation costs of the new facilities. The engineering feasibility of the port is analyzed by developing infrastructure, utility, access, and protection concepts. The airport feasibility study is concerned more with general land requirements, runway orientation, and access, than with detailed engineering needs.

The final stage of feasibility evaluation is focused upon economic analysis. Consistent with preceeding study tasks, the revenue projections and benefit/cost analyses are more developed for the deepwater port than for the airport. Various regional growth and development scenarios are analyzed and potential socio-economic impacts are studied.

Feasibility conclusions are aggregated from the siting, planning and engineering, and economic evaluations. Ultimately, the feasibility study is centered upon implementation of a well-conceived deepwater port plan and airport plan at Kotzebue.

3.0 PREVIOUS PORT STUDIES

Since 1973, four studies were conducted by various entities to evaluate port improvements and/or needs at Kotzebue. These studies have focused upon topics such as port expansion, port relocation, and forcasts of shipping demands. Both shallow-draft and deepdraft ports were studied. Of the studies that evaluated deepdraft port feasibility, one was conducted from the limited perspective of deciding Federal involvement, and the others were accomplished without comprehensive data on expanding port demands caused by impending offshore oil development and inland mining projects.

Each study is described briefly in the following paragraphs.

Feasibility for Kotzebue Small-Boat Harbor

This feasibility and preliminary engineering study for a small boat harbor at Kotzebue was prepared for the Division of Water and Harbors, Alaska Department of Public Works in 1973. The study has demonstrated that the harbor would be used and that provisions for dry storage and launching could be added to improve service. Although an adequate facility could be provided by creating navigable channels between open waters and natural harbors, the report has indicated that economic justification could not bo attained from demand levels at the time of report completion. The small-boat harbor was intended primarily for individually owned, open boats.

Engineering Feasibility Study For An Industrial Park/Port Facility at Kotzebue, Alaska

This report was prepared for the City of Kotzebue by KPFF Architecture Engineering Planning and was completed in February 1977. Funds for the study were provided under an Economic Development Administration Technical Assistance Grant. The study has shown that community and industrial growth were necessary to justify an industrial park or deep-draft docking facility. Also, at the time of study completion, the existing shallow-draft docking facility was found to be adequate for demonstrated needs. The report has recommended that its findings be reassessed as the community grows.

Western and Arctic Alaska Transportation Study (WAATS)

This regional transportation study was sponsored by the Alaska Department of Transportation and Public Facilities, and was completed in three phases by Louis Berger and Associates. Information on marine shipping, econimic trends, land and air transport systems, and environmental impacts were included in the study reports. Phase I, conducted largely in 1979, was focused upon data collection for subsequent phases. Phase II, completed in 1.981, was concerned with analysis of data', and Phase III has centered upon formulation of capital investment programs and associated budgets. A summary report was completed in 1982.

Kotzebue, Alaska, Navigation Improvements Reconnaissance Report

In response to a request from the City of Kotzebue, this report was prepared by the Corps of Engineers to determine if further Federal study is warranted €or navigational improvements to the Port of Kotzebue. The report was completed in June 1981. Several possible improvements were studied, including charting, dredging, and harbor relocation. A capital-intensive structural improvement project was determined to be unwarranted without substantial economic growth at Kotzebue. The report has recommended no further action by the Corps of Engineers. Conclusions and recommendations were based mostly upon economic feasibility as defined by Federal regulations.

4.0 PREVIOUS AIRPORT STUDIES

Kotzebue Airport, called the Ralph Wien Memorial Airport, has no master plan. A study is underway by Alaska Department of Transportation and Public Facilities (ADOT h PF) to evaluate the feasibility of relocating the terminal building. This study, The Kotzebue Airport Terminal Area/ Land Use Plan, was undertaken because of a great demand for more lease space at Kotzebue. A multi-use terminal building was conceived to free up space for use by other leaseholders by combining a number of functions in one building. Legislative funding for the terminal building was anticipated and the building required a location. The Department of Transportation and Public Facilities recognized the need for a full master plan for Kotzebue Airport. However, because a master plan required waiting for funding, plus over a year to complete, an interim solution to the terminal site problem was to develop a terminal area/land use plan.

Airport Development History

The existing airport was first constructed in 1946-1947 as a 100' X 2,880' north-south landing strip to serve the adjacent Civil Aeronautics Administration (CAA) facilities. By 1949 the CAA had extended the strip to 4,000 feet in length, and in 1950 the east-west runway was begun. Ensuing airport developments were accomplished largely as Federal aid projects (Federal Aid to Airports Program and the Airport Development Aid Program) which took place from 1950 to 1979. The developmental history of the airport is summarized in Table A-4.1.

TAEILE A–4.1

KOTZEBUE AIRPORT' DEVELOPMENT HISTORY

DATE	ACTIVITY
Late 1930's	Village of Kotzebue developed an airport site approximately three quarters of a mile north of present site called Kotzebue City Field.
1947–1948	North–South 100' x 2880' gravel strip constructed to serve adjacent Civil Aeronautics Administration facilities.
1950	Territory of Alaska, constructed the Ralph Wien Memorial Airport with a 3,750 foot by 150-foot east-west landing strip and improvement of existing 3,525–foot by 150–foot north–south strip known as the Civil Aeronautics Authority Strip.
1957–1958	Runway, aircraft parking apron, and entrance road constructed: east–west landing strip reconstructed; erosion control installed.
1958	Kotzebue City Field closed and adbandoned.
1965	Aircraft parking apron enlarged, runway lighting system reconstructed and extended, further erosion control installed.
1966–1967	Additional land acquired, east–west runway extended by 1300 feet, obstruction lighting and removal, snow removal equipment storage building construction, security fencing, permanent installation of field lighting electrical vault, expansion of parking apron.

TABLE A-4.1 (Cont'd)

DATE	ACTIVITY
1968	East-west runway lengthened by 1000 feet.
1969-1970	Runway extension, paving of runway, apron, taxiways, and airport entrance road, medium intensity runway, lighting re-heating and extender, runway and taxiway marked.
1973-1977	Further land acquition, visual approach slope indicator relo-cated, segmented circle and wind zone installed, existing equipment building converter into crash-fire-safety build-ing, new snow removal equipment building constructed.
1978	Fire truck acquired.
1978-1979	High intensity runway lighting installed on east-west runway, medium intensity runway light-ing installed on north-south runway, additional apron area paved, paving improvements on east-west runway.
1980	Additional security fencing in-stalled.
1981	Terminal relocation study begun by TRA/Farr State of Alaska De-partment of Transportation & PF.
1982	Port and Airport Feasibility Study begun by Tetra Tech/ Wright Forssen Robertson for City of Kotzebue.

5.0 DATA SOURCES/FIELD STUDIES

The project siting and preliminary engineering are based upon existing data, supplemented by limited field research. This method is used to minimize tine and budgetary requirements. A complete bibliography of published resources is included in a report appendix.

During early project stages, sone important data gaps were discovered. Onsite study efforts were required to accumulate enough knowledge for project analysis. These efforts included: 1) public meetings to determine local and governmental views, 2) an aerial reconnaissance of alternative project sites and potential construction material resources, and 3) a limited bathymetric survey and geomorphology expedition.

The list of invitees to the public meetings is contained in Appendix A. Findings and photos from the aerial reconnaissance, occurring in June 1982, are inserted into appropriate report sections. This overflight was important in acquiring overall land form data, potential access routing to port sites, and other physical setting information.

The most productive field study was conducted in July 1982. A vessel was used by Tetra Tech/Wright Forssen Associates to accomplish surveys of offshore water depths and to transport personnel and equipment to potential project sites. On-land, studies of soil conditions, drainage patterns, shoreline erosion, and other geotechnical conditions were undertaken. More detailed descriptions of survey techniques and results are contained in appropriate report sections.

EXISTING CONDITIONS

EXISTING CONDITIONS

1.0 PHYSICAL ENVIRONMENT

1.1 WEATHER/CLIMATE

Temperature

The City of Kotzebue is located on Baldwin Peninsula in Kotzebue Sound just northeast of the Bering Strait. At a latitude of 67' 52' N and longitude of 162" 38'W, it is approximately 26 miles north of the Arctic Circle (Figure B-1.1). The climate is typical of tundra regions. Mean monthly temperatures range from -7°F in February to 50°F in July. Extremes have been recorded of 85°F in July and -52°F in March. During the ice free season (late May through October) a maritime climate prevails at Koteebue. Skies are mostly cloudy, daily temperatures are relatively uniform, and the relative humidity is high. When Kotzebue Sound freezes, the climatic characteristics approach the continental type. Daily temperatures vary much more, the skies are cloudy approximately half of the time, and the relative humidity is lower.

Winds

Winds in the Kotzebue area vary with the season. The prevailing annual wind direction is from the east as shown in Figure B-1.2. During the summer however, westerly winds predominate. In general, the weather is windy with mean hourly wind velocities ranging from 10 mph in May to 15 miles per hour in January. Wind statistics during the ice free season (late June to mid-October) are shown in Figure B-1.3, and for the ice impacted season, (November to May) in Figure B-1.4. A substantial easterly wind component exists for the ice free season because of the general wind shift in late August or early September. Westerly winds occur May

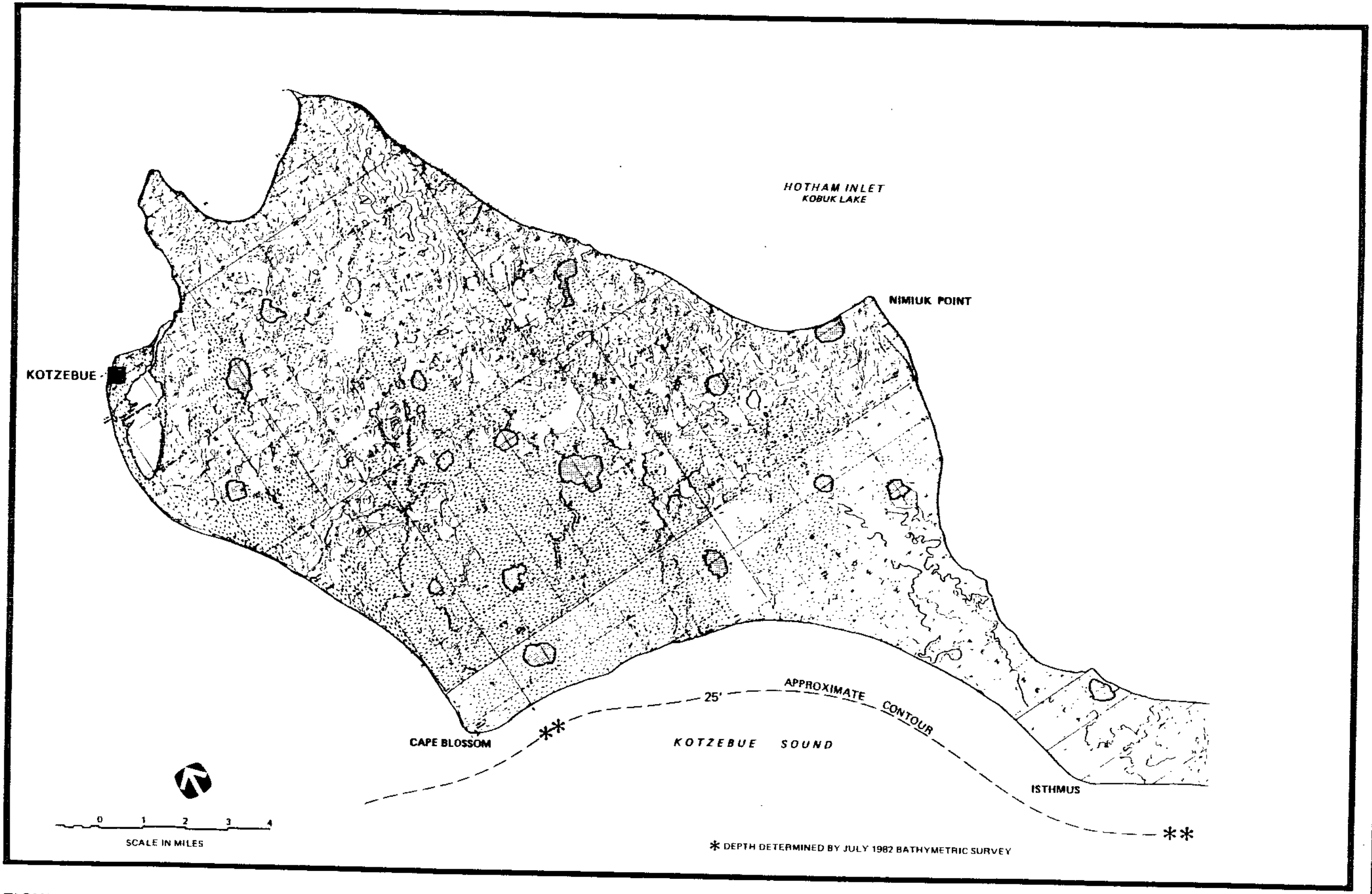


FIGURE B-I.I BALDWIN PENINSULA

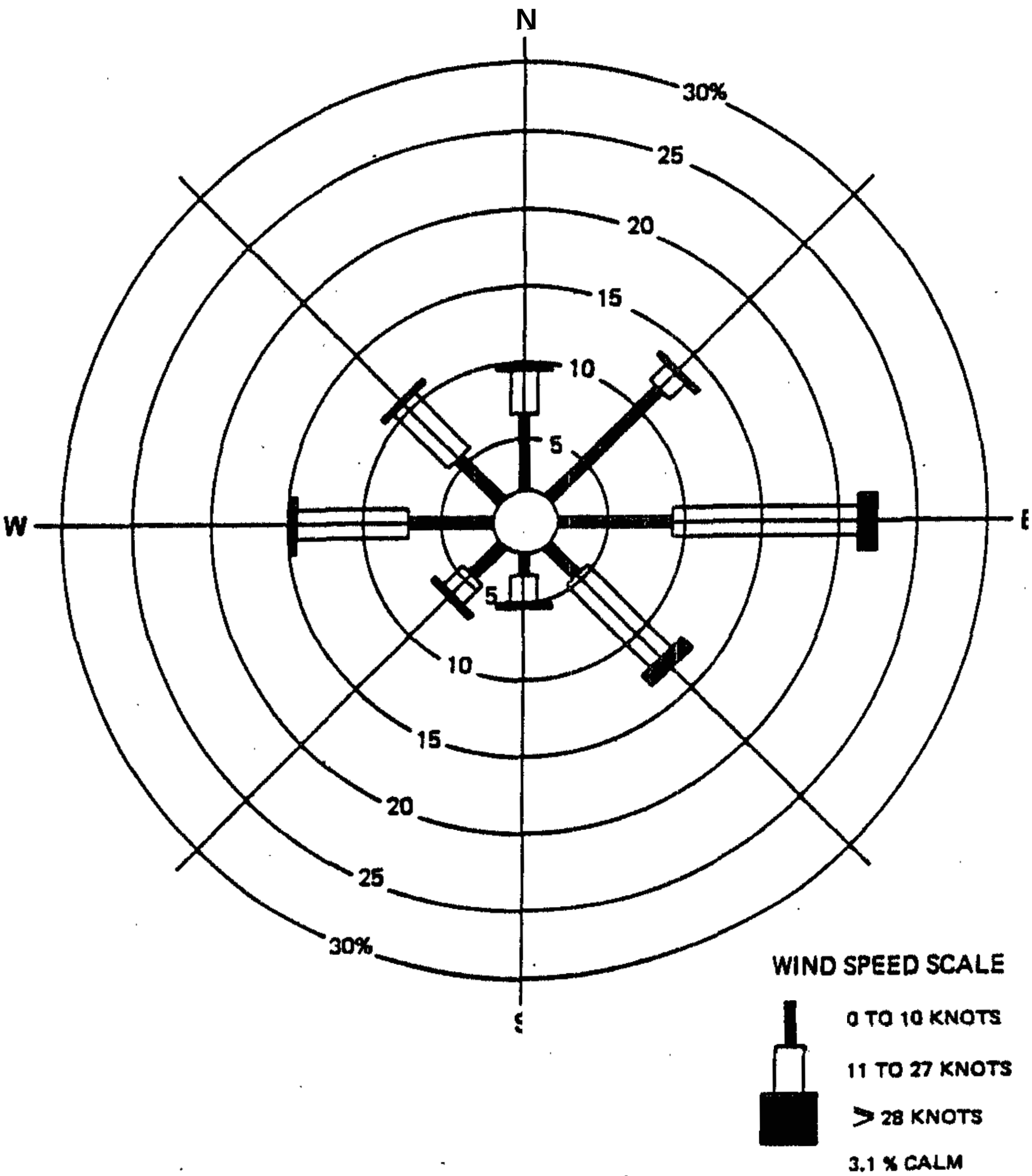


FIGURE B-1.2 AVERAGE ANNUAL WIND ROSE FOR KOTZEBUE, ALASKA

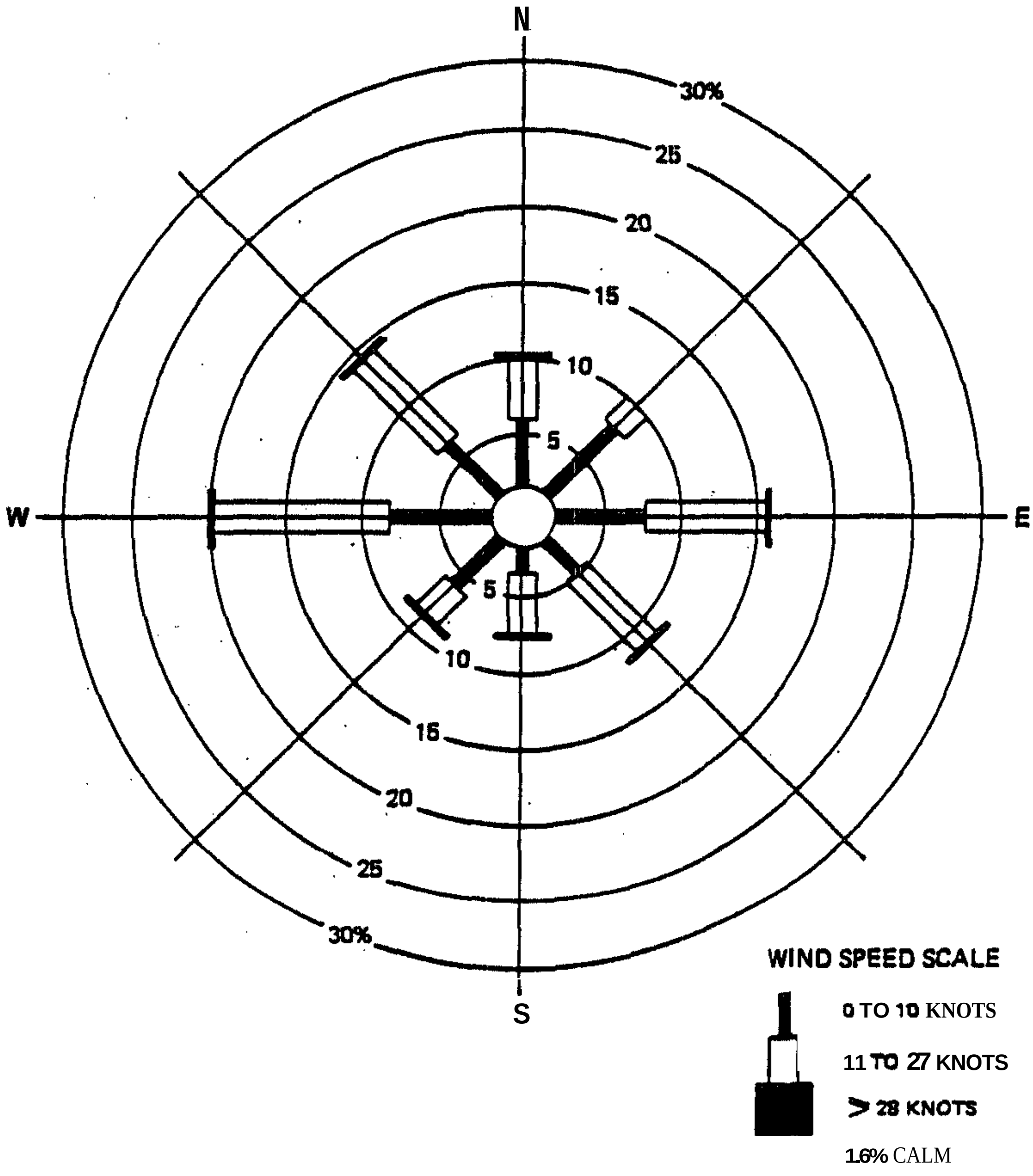


FIGURE B-1.3 ICE FREE SEASON WIND ROSE FOR KOREBUE, ALASKA (JUNE TO OCTOBER)

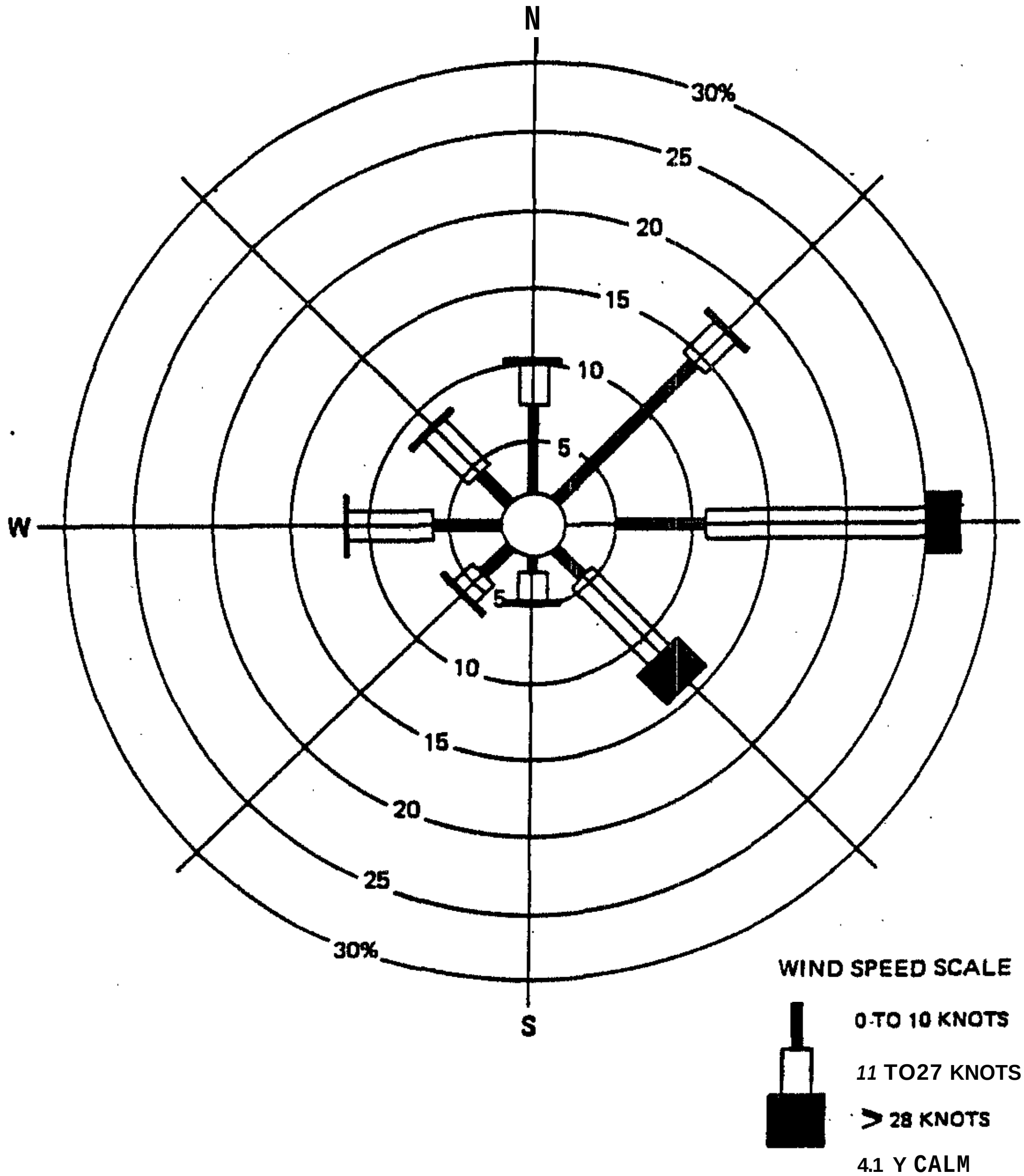


FIGURE B-1.4 ICE COVER SEASON WIND ROSE FOR KOTZEBUE. ALASKA (NOVEMBER TO MAY) through August, and easterly winds September through April. The relatively flat terrain results in unimpeded air movement throughout the year.

The Climatic Atlas, Volume III (reference 52) provides estimates of wind speeds averaged over one minute for various return periods at Kotzebue. The 10 year wind speed is estimated to be 64 mph, the 50 year is 76 mph, and the 100 year is 82 mph. Winds greater than 55 mph have been recorded from all directions except north and northeast. The fastest observed one minute wind speed was 93 miles per hour from the ESE which occurred in February 1951.

Storm Activity

Most of the low pressure systems affecting Kotzebue Sound arrive from the southwest. Common June and July storms produce wind speeds of 28 mph, with a duration of 6 hours. An average of 20 low pressure systems per year have been recorded between 1966 and 1974 in the general vicinity of Kotzebue Sound and the Seward Peninsula. Cyclonic storms are frequent, especially from October to April, and are often accompanied by high winds and blizzard conditions during the winter months.

Precipitation

The Kotzebue area receives very light precipitation with the total for a normal year being about 8 inches, over half of which occurs in July, August and September. The average annual snowfall is about four feet with snowfall generally occurring in every month except July and August.

Over the 38 year period of record, the following monthly maximum precipitation data have been recorded: August 1951, 5.18 inches; September 1977, 4.31 inches; and July 1971, 2.98 inches. The recorded maximum 24-hour precipitation of 1.78 inches occurred in July 1946. In January 1973, recorded maximum monthly and 24-hour snowfalls of 23.9 inches and 10.0 inches occurred.

Visibility

Visibility is occasionally limited by heavy fog during the summer and high wind and blizzards during the winter. In an average year visibility is limited to less than one-quarter mile on approximately **20** days. ***An*** average of approximately 60 percent of the days where visibility is less than one-quarter mile occur from April through July, with a peak occurrence in June of **5** days. Fog occurs approximately 90 days per year (ref. 55). Visibility exceeds three miles 92 percent of the time and exceeds one mile 97 percent of the time: ceilings above 1,000 feet occur 93 percent of the time (ref. 52).

1.2 GEOLOGY

General Setting

Located between Hotham Inlet and Kotzebue Sound, in the Kobuk-Selawik Lowland, the Baldwin Peninsula is composed of unconsolidated Quarternary sediments. These sediments are primarily eolian, glacial and marine in origin (ref. 41). The north-south axis of the peninsula marks the approximate front of glaciers which advanced from the east and north during the Illinoian Glaciation. The Illinoian glaciers deposited till and outwash over marine sediments. Loess (wind blown silt) was deposited over the glacial sediments during the retreat of the Illinoian glaciers. Sea level rose following the glacial retreat and in some areas marine sediments were deposited over the eolian silts.

During the subsequent Wisconsin Glaciation, loess was again deposited on the Baldwin Peninsula covering both the older Illinoian loess and the younger interglacial marine deposits. Sea level was lower during Wisconsin time than at present, but the Wisconsin Glaciation was not as extensive as the Illinoian, and glaciers did not reach the Baldwin Peninsula. Late Wisconsin and Holocene sediments are primarily retransported loess and thaw lake deposits and comprise the surficial soils which cover virtually all of the Baldwin Peninsula and the surrounding lowlands.

The above sequence of geological events during Quaternary time gives rise to the typical soil stratigraphy found on the peninsula. Surficial alluvial and lacustrine organic silts and peats overlie eolian silts which include some thin lacustrine and marine strata and in turn overlie glacial till and outwash deposits. The glacial sediments also consist primarily of silts. The oldest sediments exposed in the coastal bluffs of the peninsula are marine clays, silts, and fine sands upon which the glacial sediments were deposited.

A petroleum exploration well drilled 10 miles east of Cape Blossom near Nimiuk Point in 1974 encountered bedrock at a depth of 900 feet (Van Alen, 1982). Based on review of small scale geologic maps (ref. 32 and 44). the nearest bedrock outcrops at sea level are located on the Choris Peninsula to the southeast, at Ekichuk Lake on Hotham Inlet to the northeast, and at Krusenstern Lagoon northwest of the project site. Rock types which may be present on the Choris Peninsula are limestone, dolomite, schist, quartzite and phyllite. Rock types which may be present at Ekichuk Lake are graywacke, sandstone, shale, siltstone and conglomerate. At Krusenstern Lagoon, the rock types may be limestone, dolomite, marble and shale.

Offshore Geology

Offshore subsurface explorations have been conducted in connection with proposed extension of the Rotzebue airport runway. These explorations include borings in Kotzebue Sound in the springs of 1977 and 1982. The boring locations are on centerline and west of runway 8-26 and are from 900 to 1900 feet offshore. The borings made in 1982 reveal soils consisting of interbedded dark brown to black silty sands and sandy silts with a trace of gravel and organic material for the full depths of the borings (16 ft. and 22 ft.). The borings made in 1977 generally shows silts and fine sands to a depth of about 30 feet, underlain by gravel and sand to about 50 feet. This intermittent layering repeats to depths of about 70 feet (Ref. Shannon & Wilson Inc.).

Topography and Drainage

The Baldwin Peninsula presents a gently rolling, sometimes flat topography, the surface of which is marked by polygonal ground and thaw lakes. Broad morainal ridges rising up to 150 feet above the general surface form the topographic backbone of the peninsula (ref. 42). This rolling topography is typically bordered at the coast by bluffs 20 to 100 feet high.

The beach at the foot of the highest bluffs is usually less than 50 feet wide. In front of the lower bluffs, the beach may be 100 feet wide. The active erosion of the bluffs bordering the western edge of the peninsula is evidence of a retrograding shoreline. On the mainland north of the peninsula in the vicinity of the Sheshalik site, the shoreline appears to be prograding. There the beach consists of a flat, vegetated backshore (of approximately equal width to the foreshore; together 160 to 200 feet wide) located between low, rounded, fully vegetated bluffs and the exposed sand of the gently seaward sloping foreshore.

The lakes which dot the surface of the peninsula, and the surrounding lowlands appear to be thaw lakes that have originated due to the thawing of permafrost. Such lakes are usually shallow and freeze to the bottom in winter although some larger, deeper lakes may be potential sources of water on a year-round basis. The large lake located very close to the shore of Hotham Inlet northeast of the isthmus area may be subject to a sudden, rapid drainage in the future, should the narrow border of land separating it from the beach bluff be breached by erosion.

In the vicinity of Cape Blossom, air photos show a characteristic pattern created by abandoned thaw lake beds in which distinct polygonal ground patterns have developed. The polygonal patterns are indicative of the presence of active ice wedges. Polygonal ground is less distinct where thaw lakes are few or absent.

Streams typically follow a sinuous or gently meandering course. They appear to be of low gradient, with little sediment load. A beaded drainage pattern indicative of permafrost and ground ice is apparent at scattered locations. Most streams probably freeze to the bottom over winter and, therefore, would have very limited seasonal thaw bulbs. However, some larger streams in their lower reaches near the coast, may be potential sources of water on a year-round basis.

No springs were observed during the brief field reconnaissance of the project area. The geology of the peninsula does not appear favorable to the occurrence of springs.

In general, soils on Baldwin Peninsula are poorly drained. The active layer, which may thaw to a depth of about two feet during the summer, is typically saturated. The combination of fine grained and organic soils, gentle to flat slopes, and permafrost at the base of a shallow active layer all contribute to poor drainage conditions.

Soils

Silt (Unified Class ML), organic silt (Unified Class OL) and peat (Unified Class PT), are the predominant soil types in the project area. Brown organic silt and peat occur from the surface to depths typically between 10 and 20 feet. The thickness of these surficial soils, as exposed in the coastal bluffs, ranges from less than 5 feet to greater than 20 feet. Massive ice is a common constituent of these soils. Gray silts, typically devoid of organics, underlie the surficial soils. The gray silts commonly stand at angles of 45 to 60 degrees where exposed in the coastal bluffs. Massive ice has been observed in these silts only near the contact with the overlying surficial soils.

Sands and gravels are of very limited occurrence. Sands and gravels of glacial and marine origin were observed at scattered locations in the coastal bluffs. Glacial deposits were typically silty and limited to small lenses of stratified drift. Thin beds (generally less than 0.5 feet thick) of marine sandy gravel and gravelly sand were observed interbedded with bluish gray silty clay over a distance of approximately 200 feet at the base of the high bluff at Cape Blossom. These deposits appear to be of such limited extent as to be nonprospective as potential sources of barrow material.

The beaches observed during a July 1982 field reconnaissance were composed primarily of rounded to subangular, medium to coarse sand. Gravels, usually including some cobble size (+3") material, were of limited extent. The thickness of the beach deposits in general is uncertain. Approximately 7 feet of sand and gravel were exposed in a channel formed at the outlet of the unnamed river immediately east of Cape Blossom. In its lower reaches at the coast, this river possibly could be better described as a lake or lagoon. (At the time the site was visited, drainage to the ocean was entirely underground through the beach deposits). At the Baldwin Peninsula isthmus and at Sheshalik, the beach deposits are estimated to be at least 5 feet thick.

In the vicinity of Cape Blossom, most of the landscape is covered by abandoned thaw lake beds composed of peats and organic silts. These soils are in general very wet. Polygonal ground patterns indicate the common presence of ice wedges. High organic content and poor drainage promote a high ice content in permafrost soils.

In the vicinity of the isthmus, abandoned thaw lake beds are much less common and polygonal ground is not as well developed as in the Cape Blossom area. Peat soils and massive ice should be less common.

No soils were exposed in the bluffs near Sheshalik. Thaw lakes and polygonal ground are less common than near Cape Blossom. The soil stratigraphy at this site should be similar to that found on the Baldwin Peninsula. The overall composition of the beach at Sheshalik was visually estimated to be 90% sand, 10% gravel.

Erosion and Slope Stability. Review of air photos of the project area indicates that, with the exception of the coastal bluffs and some narrow stream valleys, slopes are gently, vegetation covered and show no .indications of instability or active soil erosion. These observations were confirmed during the field reconnaissance.

Actively eroding slopes are common to the bluffs that border the coast. In places the bluffs are completely bare of vegetation, quite steep (occasionally vertical) and cut by numerous steep walled gullies. The active erosion is the result of marine transgression and degredation of exposed permafrost. Mud flows, debris slides, and block slumping are common along the front of the bluffs. Some gullies appear to be rapidly propagating inland from the general crest line of the bluffs following ice rich zones in the permafrost soils.

Two narrow stream valleys running inland from the coast at the isthmus were observed to have unstable side slopes. Linear ground fractures extending through the surface vegetative mat to depths of 1 to 2 feet and oriented parallel to the valley were a common feature of the valley walls. At one location, a large mud "boil" had beached the surface organic mat and surfaced near the toe of the slope. These phenomena are apparently the result of degrading permafrost. The streams in these valleys are not large enough to remove all of the supplied sediment: over much of their course, the streams flow not in distinct channels, but rather as a general surface flow across a narrow, vegetated valley bottom.

Bedrock. No bedrock was observed during the July 1982 field reconnaissance. Waterborne distance from Cape Blossom to the bedrock sites previously noted, ranges approximately from 30 to 50 miles. Additional bedrock outcrops, which may be prospective as sources of armor rock, may be found on Spafarief Bay south of the Choris Peninsula, along the southern coast of Kotzebue Sound and near Tasaychek Lagoon on the coast north of Cape Krusenstern.

Faulting and Seismicity

Geologic maps of the area show no faults on the Baldwin Peninsula. Review of air photos reveals no lineations, offset surface features, or other phenomena that might indicate faulting.

The Baldwin Peninsula together with the Seward Peninsula and most of northwest Alaska is included in Seismic Zone 0 (zero) as defined in the Draft Seismic Standard for Federal Buildings (1981) prepared by the U.S. Department of Commerce. This zone designation indicates a low probability of seismic activity and a low level of seismic ground shaking hazard. There are five zone designations, 0 through 4. The geographic areas included in zone 0 are the least seismically active. Because the risk of damage from seismic actively is considered minimal within zone 0, federal buildings in this zone are exempt from the provisions of the standard.

The Uniform Building Code (International Conference of Building Officials, 1976) includes the Baldwin Peninsula within Seismic Zone 1, a designation indicating an area of possible minor damage. (Uniform Building Code seismic zones are not strictly equivalent to Draft Seismic Standard €or Federal Buildings seismic zones). The Tentative Provisions for the Development of Seismic Regulations for Buildings (Applied Technology Council, 1978) includes the project area within a zone defined by an effective peak acceleration due to seismic shaking of 0.05g, with a 90% probability that such an event will not occur within a 50-year period.

The Environmental Data Service of the National Oceanic and Atmospheric Administration maintains an Alaska earthquake data file at the National Geophysical and SolarTerrestrial Data Center located in Boulder, Colorado. A computer search of this data file identified a total of 27 earthquake epicenters located within a 100 mile radius of Kotzebue. Only one earthquake had a magnitude greater than 6, and only three had magnitudes greater than 5. Six of the 27 earthquakes had no recorded magnitude.

The earliest recorded earthquake identified in this search occurred in 1926. This does not indicate a sudden onset of earthquake activity but rather an incomplete historical record due primarily to the areas sparse population and the lack of nearby seismograph stations. At this time, the Alaska earthquake data file covers the period 1786 through May 1981. Because of the lack of information prior to 1926, the degree of seismic activity may be higher than indicated by the above data.

Permafrost

The Baldwin Peninsula occurs within the zone of continuous permafrost. A review of air photos indicates that soils throughout the project area are underlain by permafrost wet tundra, thaw lakes, polygonal ground and beaded drainage are all indicative of permafrost.

The depth of the bottom of permafrost is probably between 200 and 300 feet. A well drilled on the spit at Kotzebue in 1949 and 1950 (ref. 15) encountered the bottom of permafrost at a depth of 238 feet. A well drilled near Nimiuk Point in 1974 encountered the interpreted bottom of permafrost at a depth of 284 feet (van Alen, 1982).

The active layer, that portion of soil above permafrost which freezes and thaws annually, is probably about 2 feet deep throughout most of the project area. This depth could vary depending upon soil type, topographic position and slope direction, being shallower in abandoned thaw lake beds and deeper near the tops of hills. If areas exist that are not underlain by permafrost or in which the permafrost table is deep so that the active layer does not freeze down to the permafrost table over the winter season, such areas are likely very restricted and limited to association with relatively large lakes or rivers, or tidal flats.

The presence of permafrost and ice in poorly drained, fine grained and organic soils requires consideration of potential engineering problems which may result if the thermal equilibrium of such materials is disturbed. When such soils are caused to thaw, the excess moisture generated by the melting of ice may cause the soil mass to become unstable resulting in differential settlement, subsidence of the ground surface, and movement of the soil mass either laterally or down slope. These phenomena can, of course, severely damage structures such as roads and buildings.

During the summer, when the active layer is unfrozen, the low bearing capacity of such soils presents severe trafficability limitations. Further, if the surface organic mat is damaged, the ultimate result may be degradation of the underlying permafrost and consequent soil instability. During freeze up, such soils are subject to severe frost heaving caused by the buildup of large masses of segregated ice within the active layer.

1.3 OCEANOGRAPHY

Waves

The heights of ocean waves generated by winds are a function of wind speed, wind direction and fetch length (the distance that the wind blows over the water). Kotzebue Sound is protected from large deepwater waves except from the west through northwest directions (Figure A-1.1). Waves coming from these directions can be generated by winds blowing over fetches of 200 miles or more depending on the location of the ice pack. The Corps of Engineers has estimated a 45 mph wind with a duration of 21 hours or longer would produce a significant wave height of 19 feet. With higher winds, the waves would also be higher. Local residents report having seen wave heights of approximately 20 feet around Cape Blossom.

The City of Kotzebue is protected from the large deepwater waves by shallow water offshore. The large waves break at the first sand bar and continue on to Kotzebue as much smaller waves. Southerly areas of western Baldwin Peninsula are not protected by shallow water far offshore so the large waves break close to shore.

There are two main sources of wave observations for Kotzebue Sound and Chukchi Sea. The Summary of Synoptic Meteorological Observations (SSMO) Volume 15, area 17, lists wave observations for latitudes 66" to 70° north, and from the Alaskan Coast to 170°W longitude. The largest waves listed are in the 17-19 foot category, with a period of 10-11 seconds. This data is a compilation of shipboard measurements from 1963 to 1969. Since ships tend to avoid bad weather, this data generally is biased toward good weather samples.

The second source is the Climatic Atlas of the Outer Continental Shelf Waters and Coastal Regions of Alaska, Volume 111. Marine Area C covers latitudes 65' to 70°N, and from 180°W longitude and the coast of Siberia, to the coast of Alaska. The largest reported waves were 8 meters (approximately 26') with a period of 6 to 7 seconds, and from the southwest direction. The largest waves coming from the west or northwest (possibly getting into Kotzebue Sound) were in the 20 to 25 foot category, with a period of 6 to 7 seconds.

Tides

Tides at the City of Kotzebue are very small. The U.S. Army Corps of Engineers reports that tides at Kotzebue are of the mixed semidiurnal type with a normal. range of 1.5 feet (ref. 21). Mr. Royal Harris, manager of the Arctic Lighterage Company, reports that sea level changes due to tides are not noticeable at the dock, but that winds can cause sea level changes of over 6 feet. Tne ciosest tide gauge is at Kiwalik on the southeastern shore of Kotzebue Sound. It records .an average diurnal tidal range of 2.7 feet with a maximum range of 4.2 feet.

Currents

Very little data exists on currents in Kotzebue Sound. They generally flow in a counterclockwise direction, and average

0.5 knots (Ref. 21). The United States Coast Pilot (Ref. 55) reports an average tidal current of 0.5 knots at the anchorage southwest of Cape Blossom, the flood tide sets southeast and the ebb northwest. Observations also show a northwest nontidal flow which sometimes has sufficient velocity to overcome the tidal current and produces a continuous northwest current of varying velocity for days at a time. The maximum northwest flow is 1 to 2 knots. This applies only to the ice-free season.

Bathymetry

Little bathymetric data exists for Kotzebue Sound. Nautical Chart 16005, Cape Prince of Wales to Point Barrow, shows a large portion of the sound to be seven to nine fathoms (42 to 54 ft.) deep. Sand bars or shallows exist in an area from Hotham Inlet to Cape Blossom, and from just offshore out approximately 13 miles. Certain channels in this area are over thirty feet deep, but the controlling depth over the outer sand bar is approximately 6'. These shallows are apparently deposits from the many rivers that empty into Kotzebue Sound through Hotham Inlet.

To increase our knowledge of the nearshore bathymetry, four lines were surveyed offshore at various locations (see Figure B-1.5). The lines were started just offshore and continued until water depths were greater than thirty feet or until the boat was more than two miles aut. The distance from shore and the depths were plotted €or each line and are presented in Appendix F. The line running south of Cape Blossom shows the twenty five and thirty foot water depths closest to shore. The bottom was found to be gently sloping with water depths of twenty-five feet occurring 4000 feet offshore, and depths of thirty feet at 6400 feet offshore. The line to the west of Cape Blossom shows a depth of only twenty feet over two miles out. At the isthmus, water depths of twenty-five feet were found approximately 5900

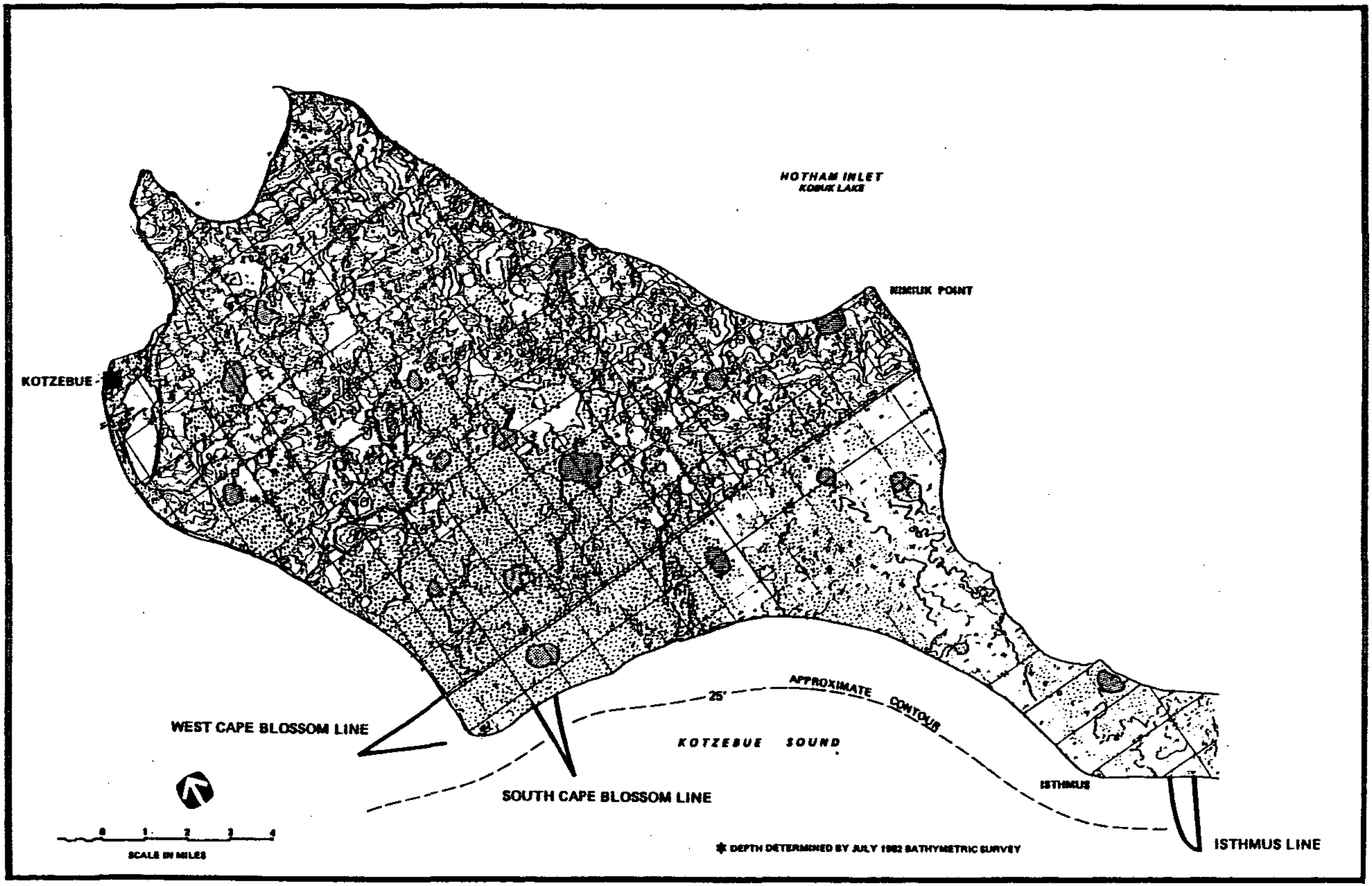


FIGURE B-1.5 LOCATION OF BATHYMETRIC SURVEY LINES feet from shore, and thirty foot depths were found approximately 7600 feet from shore.

Littoral Drift

Littoral drift along the shoreline at Kotzebue has been studied by various sources to determine solutions to the continuing erosion problem. The Corps of Engineers study (Ref. 19) describes existing conditions. Various methods to solve the erosion problem were demonstrated by a Corps of Engineers Demonstration Project (Ref. 16). The net littoral drift at Kotzebue is to the north with manmade obstructions along the coast causing erosion to the north and deposition to the south of the obstruction.

For areas below Kotzebue, no previous studies of littoral drift have been made. During the site visit, littoral currents appeared to be moving to the west at the south Cape Blossom site, and to the south at the west Cape Blossom site. At the isthmus no particular direction could be discerned. These observations have no bearing on the net littoral drift since littoral currents rarely move in only one direction during the entire year.

Ice

The characteristics of the sea ice at Kotzebue are not typical of sea ice in the Chukchi Sea. Due to water depths of less than four feet offshore, the ice becomes grounded and does not move until breakup in June. Because of the lack of movement, the ice does not build up on shore or form pressure ridges close to shore. Ice can be pushed onshore during breakup if the wind is from the west.

At Cape Blossom, little information is available on ice characteristics. Local reports indicate that the ice is similar to ice at Kotzebue with very little riding up on shore.

Ice coverage in the pack ice zone is given in oktas, where an okta is defined as one eighth of the total surface area. The Climatic Atlas (Ref. 57) shows the mean extent, the northern limit, and the southern limit, of five oktas of ice coverage during each month. During May, Kotzebue Sound is covered by greater than five oktas of ice. On the average, Kotzebue Sound is covered with less than five oktas of ice during June, but coverings greater than five oktas are still possible. During July, the mean extent of five oktas of ice is far north of Kotzebue, but the extreme southern limit just barely includes Kotzebue. Ice does not occur at Kotzebue during August or September, and October is similar to July in ice coverage. During November, it is possible for the ice coverage to be less than five oktas, but on the average, coverage is greater than five oktas. This data agrees with reports of ice usually breaking up during June and freezing during October on Kotzebue Sound.

1.4 HYDROLOGY AND RIVERS

There are no major rivers on Baldwin Peninsula, but there are some small streams. June Creek, approximately 2½ miles south of Kotzebue, has a drainage area of 10.9 square miles, and was gauged from June 1965 to September 1967. Flow rates appear to be fairly variable. In June, the average discharges range between 40-50 cubic feet per second (cfs) and range between 1-10 cfs during other months.

Sadie Creek, approximately 6 miles south of Kotzebue was gauged at least four times by U.S. Geological Survey, and flow rates ranged from no flow in April to flows of 14 cfs in July, 62 cfs in August, and 264 cfs in September.

The major rivers in the study area are the Kobuk, Noatak, and Selawik. The rivers are generally ice free for four to five months each year, and during these periods are used to barge goods to upstream villages.

D

1.5 FLOOD HAZARDS

Storms originating in Siberia cause the largest storm surges and flooding in Kotzebue. The National Weather Service has estimated that winds of 40 knots or more from the west must be sustained for coastal flooding to occur at Kotzebue. The Army Corps of Engineers has estimated the 100 year flooding elevation to be 9.1' along the coastline, and 5.2' inland. The elevation of 9.1 includes wave action.

2.0 BIOLOGICAL SETTING

2.1 OFFSHORE BIOTA

Several important animal species exist in Kotzebue Sound, and many are important to Subsistence or commercial activities. These include arctic char, whitefish, chum salmon, beluga whales, and ring seals.

Arctic char migrate immediately adjacent to the beach and travel from south to north along Baldwin Peninsula. Many established subsistence fishing grounds for arctic char exist between Cape Blossom and Kotzebue. Whitefish also is important to subsistence in the area. Offshore, whitefish tend to be found in the natural channels leading from Hotham Inlet.

Chum salmon is the most important commercial fishery. These fish tend to migrate along shore. Spawning habitats principally exist in the Noatak, Kobuk, and Sclawik Rivers, although other large streams or rivers also are important.

Beluga whales are hunted for subsistence purposes. Both young and adult whales arc found in Kotzebue Sound, especially in Esholtz Bay. During winter months, ring seals are hunted close to shore. These mammels also are used for subsistence needs.

2.2 ONSHORE BIOTA

The wet tundra and larger streams on Baldwin Peninsula offer a good habitat for waterfowl and whitefish. Waterfowl use the stream mouths for resting, staging, some nesting, and feeding. The Baldwin Peninsula offers areas for the massing of birds prior to fall migration. There have been few biological studies on Baldwin Peninsula, and little is known about the stream populations.

2.3 WILDLIFE REFUGES

Two national refuges for wildlife exist within the Kotzebue Basin. One is located in the southeastern corner of Kotzebue Bay and is called the "Alaska Maritime National Wildlife Refuge." This refuge consists of rocky islands and surrounding waters south of Choris Peninsula. Birds utilize these islands very heavily for nesting and other activities.

The "Selawik National Wildlife Refuge" .is located easterly of Kobuk Lake along the Selawik River drainage area. This refuge supports a wide variety of biota typical to this region of Alaska.

3.0 HUMAN ENVIRONMENT

3.1 SOCIAL/CULTURAL FACTORS

General Growth History

Located at the center of ancient arctic trade routes, Kotzebue has been a settlement site for centuries. The Kotzebue area shows evidence of continuous Eskimo residence for at least 600 years. Consistent with the traditional lifestyles of Eskimos, the settlement pattern of the original village was oriented along the waterfront. The gravel beach ridge furnishes not only good building sites, but also advantageous access to Kotzebue Sound.

Originally established as a fish camp called Kikitaruk, in 1887, a reindeer station was subsequently established at Kotzebue and the community became a permanent settlement. The discovery of gold on the Seward Peninsula in the early 1900's brought more people to the region. The nearby gold mining community of Candle had a population of some 2,000 during its peak in 1902 and 1903. Also, coal was mined at Chicago Creek and on the Kugruk River until 1947.

Over the next 30 years, Kotzebue grew slowly but steadily. The post World War II period brought an expanded role for the community and concomitant growth of population and development of a service infrastructure. This change grew largely out of the federal government's increasing commitment toward upgrading the health, education and other service opportunities for Alaska natives. Kotzebue, because of its geographic location and relative size, is the gateway to the more remote villages in northwest Alaska (see Figure A-1.1). The community is now the major transfer point between ocean and inland shipping as well as a major air transport service center in the region. No overland transportation network currently exists in the region.

Population

The population of Kotzebue has shown a pattern of steady growth prior to 1940, with more rapid expansion characterizing the post-World War II period. Kotzebue doubled its population between 1950 and 1960, jumped another 39 percent in the 1960's, and increased almost 50 percent between 1970 and 1978. Equally significant, is the changing role of Kotzebue in the region. In its early history, the City was estimated to contain only 10 to 15 percent of the region's population. By 1960, this ratio was approximately 36 percent, and remained fairly stable up to 1970. During the 1970's, the ratio increased to almost 50 percent of NANA region's population (Kobuk census area).

Table B-3.1 compares the City of Kotzebue and the NANA region at selected points in time. Population in the region more than doubled in the 1940-1981 period, an average annual growth rate of approximately **2.23** percent. In comparison, the population in the City of Kotzebue during the same period increased at an average annual rate of 4.26 percent. The table also indicates that the larger villages experienced a continuous but erratic population growth over the last forty years.

A steady growth in employment opportunities apparently attracted regional residents to Kotzebue. In a 1979 survey, 39 percent of the Kotzebue population indicated they had lived in another part of the region prior to residing in Kotzebue, 38 percent of the sample migrated to the City for employment reasons, and another 38 percent indicated they were born in Kotzebue. The major employment opportunties which contributed to this growth appear to be associated with Local and State governments and the newly formed profit native corporations).

Table B-3.1 POPULATION OF NANA REGION

AREA	1940	1950	1060	1970	1980	% Change 1940–80
Kivalina	98	117	142	188	241	2.28
Noatak	336	326	275	293	273	(-0.92)
Kotzebue	372	623	1,290	1.696	2,054	4.36
Noorvik	211	248	384	462	492	2.14
Kiana	167	181	293	278	349	1.83
Selawik	239	273	348	361	429	1.47
Ambler		—	70	169	192	9.17
Shungnak	193	141	135	169	202	0.11
Kobuk	31	38	94	96	62	1.79
Deering	230	174	95	85	150	(-1.06)
Candle	119	105	103	—	5	(-7.62)
Buckland	—	108	87	104	in	1.66
NANA Region	1,996	2,334	3,236	3,897	4,662	2.14

Source: 1. NANA Region: It's Resources and Development Potential.
2. Alaska Department of Labor Alaska Population Overview.

Although a number of sources provide current estimates of regional and local population in the study area, there are few long-range projections of future population, and the available historical demographic data is clearly imprecise. To the extent that such projections have been published, the results have been used as appropriate. For these reasons population projections in Table B-3.2 have been based on three alternative rates of growth: low, probable, and high. These alternative growth rates are intended to reasonably describe the possible range of future population growth, and provide a range from which sensitivity analysis can be carried out with respect to the deepwater port development.

The population forecasts are based on: available census data from the Alaska Department of Labor: population projections including those presented in the Beaufort Sea and Bering - Norton studies of Alaska Outer Continent-a1 Shelf program; the National Petroleum Reserve - Alaska final studies report: and various other reports including the WAATS transportation report (Ref. 7). The base year from which these forecasts were computed is 1980. The population projections are input data for determination of other socioeconomic forecasts, including employment, income, and consumption. Population and socioeconomic factors are further used to determine potential transportation demand.

Political Status

The City of Kotzebue has a city council with a city manager. One member of the city council is elected to act as mayor. A city manager is hired to conduct city business. Kotzebue is a second-class city and has assumed many of those powers authorized by state statutes.

Land Status

Most of the land in the project area is owned by the Federal government and managed by the Bureau of Land Management.

Table B-3.2 POPULATION FORECASTS-- NANA REGION

				REGIONAL PROJECTIONS											
				LOW*				PROBABLE**				HIGH***			
AREA	1960	1970	1980	1985	1990	1995	2000	1985	1990	1995	2006	1985	1990	1995	2000
Incorporated Areas*															
Ambler	--	--	192												
Buckland	--	104	177												
Candle	--	--	5												
Deering	--	--	150												
Kiana	--	278	345	(detailed projection breakdown cannot be made with confidence)											
Kivalina	--	188	241												
Kobuk	--	—	62												
Kotaebue	1,290	1,696	2,054												
Noatak	--	273	293												
Woorvik	--	462	492												
Selawik	--	361	429												
Shungnak	--	165	202												
Regional Total	3,236	3.857	4,662	5.337	5.852	6,417	7,036	6,243	7.211	8,333	9,627	7,322	8,920	10,869	13,243

Source:

* Alaska Department of labor. Alaska Population Overview, 1981.

** Baaed on average annual growth rats of 2.93% calculated using 1980 Censun Data and the WAATS Reports "Most Probable. growth scenario assumption that includes increased mining activity,

*** Based on an average annual growth rate of 4.03% calculated using 1980 Census Data in the WAATS Reports 'Most Probable growth senario assumption adjusted for total average OCS employment impact.

Much of the land is subject to native regional and village corporation selections. Some land has been patented or is in an interim conveyance status. Village corporations have filed on lands, with NANA top filing over the village corporations and the State top filing over both. None of the sites are located within National Interest Lands. Final conveyance of lands has been underway for several years and may not be resolved in the immediate future. In the interim, all parties having an interest in the parcel under investigation must be consulted. The State of Alaska owns tide lands and lands under navigable rivers and may ultimately receive patent to some lands in the project area.

3.2 ECONOMIC EASE

Employment

The Research and Analysis Section of the Alaska State Department of Labor publishes non-agricultural employment, wage and salary data by industry on a quarterly basis for the State as a whole and for each of 29 regions. Data pertaining to the City of Kotzebue, however, is not disaggregated from regional data. Despite this, Kotzebue's historical role as the primary employment center in the region gives this information importance in describing general employment trends.

Historically, the region's employment grew steadily in the 1970's. The annual rate of growth averaged almost 11 percent between 1970 and 1981. The only consistent industrial employment increase came from state and local government. By 1980, almost 45 percent of all employment was due to state and local government.

The remaining industrial classifications are composed of undiscloseable data which makes interpretation more difficult. Mining remains more a potential than an immediate reality, although a number of mine developments in the region have been recently proposed. The same is apparent for manufacturing. Construction is another important area and typifies the seasonality of employment in the region. The Kobuk census division has always had significant seasonal fluctuations reflecting increased economic activity during the May through September months. Seasonal surges in employment typically occur in construction, transportation, utilities and communication, mining and manufacturing industries (fish processing). Unfortunately, sufficient data is not available to indicate whether seasonal employment trends have altered over long-term periods. The strength of: the year-around economy is tied to the very heavy dependence on government employment or government related contracts.

The total civilian labor force in the Kobuk region was estimated at approximately 2,530 in March 1981, with an average unemployment rate of 11 percent. The total number of employed persons averaged 2,244 during the same time period (Alaska Department of Labor Force Highlights, April 1981).

Subsistence is still a strong component of the Kotzebue Lifestyle. Subsistence activity by Kotzebue residents is significantly less than that of village residents. However, only 14 percent of the households in Kotzebue have no dependence on subsistence activities. Conversely, 37 percent depend on subsistence for 50% or more of their needs (Northrim Associates, 1979).

Subsistence activities vary. About 65 percent of the households pick berries; 54 percent fish for tomcod, and 44 percent for salmon. Caribou hunting is pursued by 42 percent and moose hunting by 41 percent. In contrast, only 6 percent have a garden and 4 percent make handicrafts. Roughly two-thirds or more of the regional food consumption still comes from hunting and fishing. When asked what the main source of meat was; 45 percent said caribou and 20 percent said chicken. Recalling 10 years ago, 69 percent of the survey said caribou and none said chicken. (Northrim Associates, 1979).

Tourism

Kotzebue, because of its location and accessibility, is one of three villages in Northwest Alaska that attracts hundreds of tourist each summer. Tourist from all over the world travel to Kotzebue to better appreciate the Eskimo's unique culture. Kotzebue offers sightseeing tours, excellent sport fishing, hiking, camping and canoeing. In addition, several new national monuments are accessible from Kotzebue. Regular jet service connects Kotzebue with Nome, Anchorage and Fairbanks. Facilities in Kotzebue include a modern hotel and several restaurants.

Fishing Industry

The commercial salmon fishery in the Kotzebue Sound is small by comparison with other fishery areas in the State, although roughly similar to that of Norton Sound in terms of the number of fish caught. The City of Kotzebue is the center of the region's fishery. Of the total 182 commercial salmon entry permit holders, 134 have a Kotzebue address. There are several commercial buyers in Kotzebue, including a fishermen's cooperative. Although some fish are processed and flown out in the round by the Cooperative, the greatest portion is partially processed and transported by lighter to Japanese freezer ships. Due to the limited degree of local processing, the need for processing labor is. not large. Without port development, the annual salmon harvest is projected to average 600 metric tons between 1980-2000, with fishing and processing employment remaining stable at approximately 180 and 6.5 man years respectively.

Reindeer Industry

There are presently only a few major reindeer herds in the NANA Region. Potential development of the existing reindeer industry depends on an increase in herd size and on development of processing and storage facilities to market winter-killed reindeer for regional distribution.

The most obvious method of increasing the supply from regional herds is to increase the size of herds, either by bringing in outside reindeer, or by allowing existing herds to build up while supplying Kotzebue from other herds. For example, the Clark permit in the Candle area has a limit of 5,000 animals, and there are less than 1,000 on the range now. The Karmun-Moto herd is very near its limit (1,500 reindeer), whereas the Gray and Hadley herds could jointly add another 1,000 head and be at their 5,500 head limit.

Petroleum Industry

Petroleum potential in the NANA region appears to be relatively small for the short term but somewhat more significant over the long term. The benefits to the people of the region will depend fundamentally on three factors: the size of the reserves found, the type, and the location. Continued exploration and possible development of onshore and offshore oil and gas deposits potentially offer major industry developments in the NANA region. Rising demands increase the likelihood of oil and gas exploration and development facilities being located in the NANA region. Kotzebue is a probable location for this type of activity because of its proximity to the Chukchi Sea and Hope Basin offshore leasing areas and its in-place regional air transportation facilities.

Federal lease sales of oil and gas tracts in the Outer Continental Shelf areas of the Chukchi Sea are not scheduled until mid-1985. In addition, the State of Alaska's 5-year lease schedule calls for sales in the onshore and tidal areas of the Kotzebue Basin and Sound at the same time as does the Federal OCS schedule. The limited information available on possible oil and gas development activity in Western Alaskan OCS areas makes it difficult to predict the levels of economic impact Kotzebue may experience. The State of Alaska's report on the State's proposed lease schedule notes only that oil potential in the Chukchi Sea is unassessed, with industry interest characterized as moderate.

Kotzebue could function as the center for an air transportation network related to oil activity north of the Seward Peninsula. The greater number of current air connections to Anchorage, and better flying weather, make Kotzebue the likely choice as an air transportation center. Additionally, warehouse and loading space at the city port would be required. Air traffic at or near the airport would increase drastically. Supporting commercial activities, such as hotel and restaurant services, would be affected.

Onshore petroleum exploration activity may also occur before 1990. Kotzebue would serve as the central supply and transportation center for the early stages of onshore exploration. Transportation of equipment, supplies and crew to and from drilling sites would create activity in the local transportation, trade, and service sectors.

Mining

The value of almost all minerals has increased dramatically in recent years. In the past, major gold mining operations were worked in the hills surrounding Candle. Today, due to rising gold prices, limited gold dredging operations have resumed in the area. Two major mineral districts have emerged in this region - the Shungnak and Red Dog/Lik mineral districts. The Shungnak mineral district is located in the Schwatka Mountains northeast of Shungnak. It is estimated to contain $9 billion worth of copper, lead, zinc, silver and gold at 1980 prices. To date, the only activities in this district have been exploratory. Mineral development is hampered by high operating and transportation costs and problems relating to access and rights-of-way.

The Red Dog/Lik mineral district in the Delong Mountains, 85 miles northeast of Kivalina, shows promise of actual development starting in 1983. This district contains massive lead-zinc-silver deposits, along with barite deposits that are in high demand as a drilling compound. ComincoAmerican Ltd., General Crude Oil and NANA Development. Corporation have the principal mineral interest in this district. To date, no detailed development plans have been announced. Based on an assumption that NANA Development Corporation will move to develop these resources, however, the following activities/schedule may be expected. During the 1982-83 summer construction seasons, preliminary development programs will be initiated that provide for: additional exploratory drilling: bulk sampling of mineral ores; planning and environmental assessment for mining infrastructure including airports, labor camps, and deepwater port facilities: and permit/regulatory compliance preparations.

Although **coal** reserves near tidewater may have greatly increased demands made on them by E'acific Rim nations (e.g., Japan, Korea), freeze-up conditions in Kotzebue Sound and high transportation costs will continue to restrict the development of the Chicago Creek reserves until new port facilities are developed.

Transshipment Industry

The port of Kotzebue is characterized by two important shipping activities. The first involves lighterage of all incoming cargo from offshore anchorages to the port at Kotzebue. The second is the transshipment from the port to various villages within the region. Transshipping to destinations beyond Kotzebue is by means of coastal and river barges, mainly on the Kobuk River, which has navigable depths of five feet up to Kiana. Deliveries to the upper reaches of the Kobuk River and to the Noatak River are made during earliest days after spring breakup when water depths are greatest. During both 1979 and 1980 nine ocean-going barges called at Kotzebue. The intervals from first to last visit in year 1980 was 92 days (28 June through 24 September), whereas in the previous year the interval was only 66 days (19 July through 20 September).

PORT SITING ANALYSES

4.0 PORT OPERATIONS AND NEEDS

4.1 FACILITIES DESCRIPTION

The present dock is located in the northwest part of town, adjacent to the Chevron Tank Farm (see Figure B-4.1). Barge storage facilities are located slightly further up the coast. The port is slightly over 1 mile from the airport.

The facility has a shallow draft of 6-8' and is constructed with a linear tied - back sheet pile bulkhead. The owner/operator of the facility is Arctic Lighterage. The dock was owned previously by B & R Tug & Barge. Fuel storage tanks, operated by Arctic Lighterage, contain approximately 6 million gallons of bulk fuel. Total acreage available for port operations and storage is about 6 acres.

4.2 THROUGHPUT

Present

Incoming dry cargo is received mainly in 20 foot size containers or in other similar unit loads. It is reported that approximately one-half of the containers are less than a full load for a single consignee and, therefore, are often reconsolidated before transshipment to their ultimate destination.

Nine ocean-going barges arrived at Kotzebue in 1979 and again in 1980. Incoming waterborne cargo during the six years from 1975 to 1980 is summarized in Table B-4.1. Over that six year period, the total amount of incoming cargo has remained somewhat constant, although the composition of the cargo has changed significantly. Whereas bulk fuel imports increased by 6.2 percent from 1975 to 1980, dry cargo tonnage declined by 21.5 percent. Discounting 1976, bulk fuel reached a high of 87.4 percent of all inbound cargo through the Port of Kotzehue in 1977.

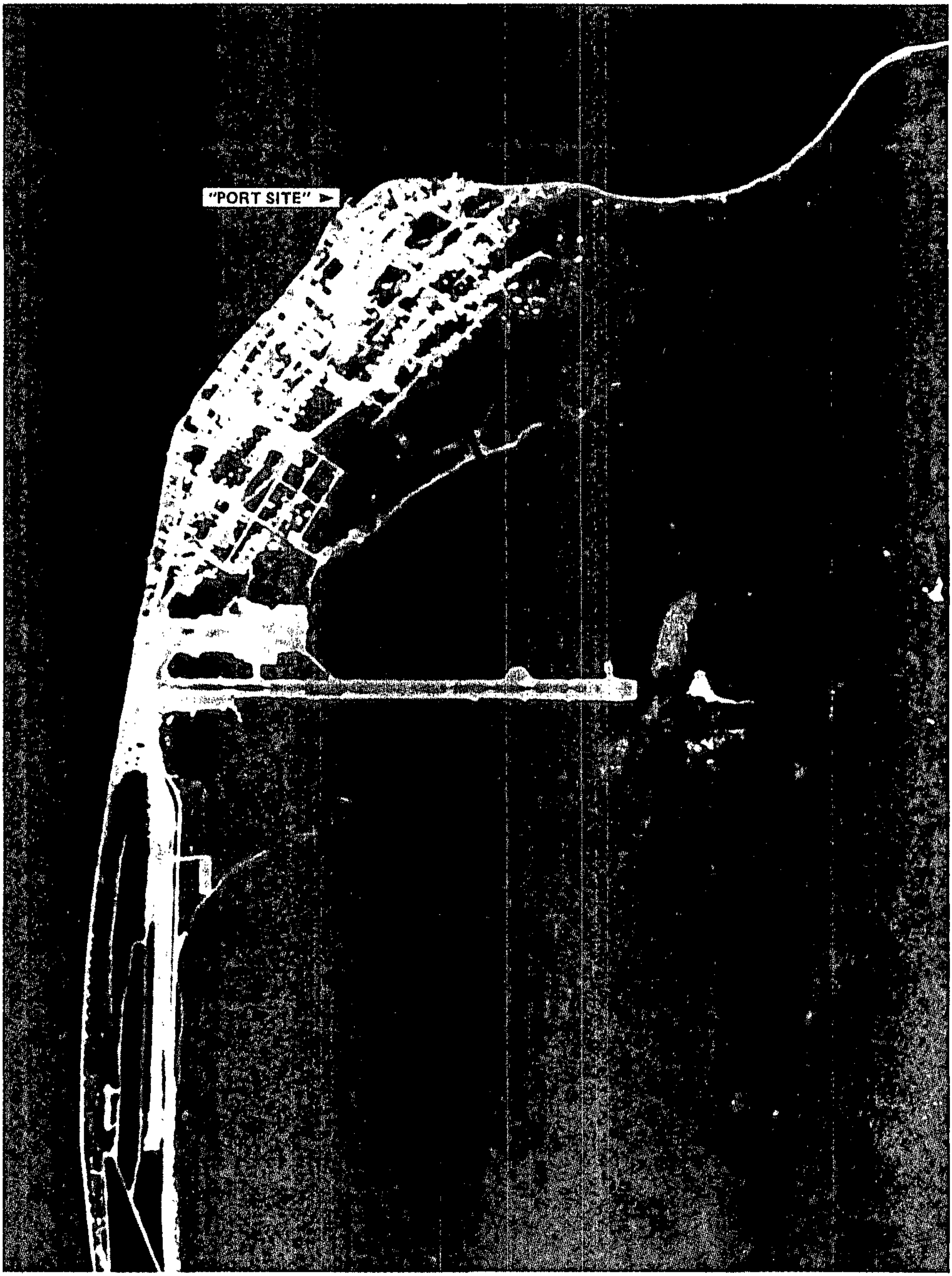


FIGURE B-4.1 CITY PORT SITE

Table B-4.1 WATERBORWE CARGO, KOTZEBUE - 1975 to 1980 (Actual Tons)

CARGO	1975	1976	1977	1978	1979	1980	6 YEAR AVERAGE
INBOUND							
Bulk Fuel	19,659 73.8%	22,312 99.2%	20,890 87.4%	24,335 85.9%	23,427 84.9%	20,873 79.2%	21,916 84.7%
Dry Cargo	6,989 26.2%	176 0.8%	3,017 12.6%	3,993 14.1%	4,167 15.1%	5,489 20.8%	3,972 15.3%
Total	26,648 100%	23,488 100%	23,907 1008	28,328 100%	27,594 100%	26,362 100%	25,888 100%
DUTBOUND TRANSSHIPPED							3 YEAR AVERAG
Bulk Fuel	NA	NA	6,388	HA	5,528	4,501	5,472
Dry Cargo	NA	NA	1,442	HA	2,273	1,668	1,794
Total	6,804	9,143	1,830	7,487	7,801	6,469	7,266
Outbound Cargo % of Inbound Cargo	25.58	40.7%	32.89	26.4%	28.38	23.4%	29.1%
TOTAL	33,452	31,631	31,737	35,815	35,395	32,531	33,427

Source; Reference 7

Transshipped cargo during the six year period has averaged 7,539 tons per year. No meaningful. trend can be established from the cargo data, although some of the year-to-year variations can be attributed to the non-uniformity of construction activities in the region.

Up to 18 destinations are being served from the Port of Kotzebue, the largest volumes going to the communities of Kiana, Noorvik, Selawik and, in 1979, Barrow. Transshipments from Kotzebue to regional communities for 1979 and 1980 are summarized in Tables B-4.2 and **B-4.3.**

Future

Projections of future waterborne cargo shipments through the port at Kotzebue are dependent upon forecasts of activities in a number of areas. These include the traditional import and transshipment of refined fuels, general commodities, and construction materials. In addition, consideration is given to the newly emerging areas of mineral production and oil and gas development and production.

Fuels. In the category of refined fuels, forecasts made in the WAATS Phase III study were based upon population and income forecasts for each community in the region. During the period **from 1985** to 2000, substitution of locally available fuels for heating and power generation is expected to occur in some communities. This fuel substitution is projected to significantly reduce imports through Kotzebue and transshipment activities at the port. Table 8-4.4 displays forecasted fuel quantities based upon the most probable population and income projections.

General Commodities. General commodities include food, beverages, transportation equipment and other items for household consumption or business use. Transportation of these items is either by air or marine transport. Table

Table B-4.2 TRANSSHIPMENTS FROM KOTZEBUE - YEAR 1979

DESTINATION NAME & (CODE)	BULK FUEL GALLONS	BULK FUEL TONS	DRY CARGO TONS	ALL CARGO TONS	FUEL % OF ALL CARGO
Noatak (303)	69,900	243	179	422	98
Shungnak (309)	133,160	466	238	704	66
Kiana (306	179,320	628	412	1,040	60
Ambler (308)	78,156	277	89	366	76
Kobuk/KC Land (310)	23,900	e4	64	148	97
Noorvik (30.5)	181.440	635	215	850	75
Selawik (307)	166,523	583	477	1,060	95
Deering (307)	37,000	130	178	308	42
Buckland (31.5)	96,500	33s	237	575	99
Shishmaref (403)	46,000	161	30	191	84
Nome (408)	—	—	n	72	—
Lisburne (209)	—	—	3	3	—
Pt. Lay (208)	—	—	8	8	—
Barrow (205)	949,832	1,924	—	1,924	100
Kivalina (302)	18,000	63	20	83	76
Pt. Hope (301)	—	—	10	10	—
Wainwright (207)	—	—	7	7	—
Kiwaulik (317)	—	—	33	33	—
TOTAL	1,979,332	9,928	a,273	7,801	71

Source: Artic Lighterage Company, Koczebue

Table *B-4.3* TRANSSHIPMENTS FROM KOTZEBUE - YEAR 1980

DESTINATION NAME & (CODE)	BULK FUEL GALLONS	BULK FUEL TONS	DRY CARGO TONS	ALL CARGO TONS	FUEL % OF ALL CARGO
Noatak (303)	126,000	441	2	443	100
Shungnak (309)	129,000	451	58	510	89
Kiana (306	229.000	802	336	1,138	71
Ambler (308)	103,000	361	81	443	82
Kobuk/KC Land (310)	14,000	49	1s	64	76
Noorvik (305)	220,000	770	296	1,066	77
Selawik (307)	297,000	1,040	273	1,319	79
Deering (307)	23,000	81	141	221	37
Buckland (315)	83,000	291	54	34s	84
Shishmaref (403)	42,000	147	26	173	89
Nome (408)	—	—	167	167	—
Pt. Lay (208)	—	—	22	22	—
Barrow (205)	—	—	1	1	—
Kivalina (302)	20,000	70	n	147.1	48
Pt. Hope (301)		—	8	8	—
Wainwright (207)	—	—	4	4	—
Other	—	—	L00	100	—
TOTAL	1,286,000	4,504	1,618	6,169	73
CHANGE FROM 1979		-18.6%	-26.68	-20.99	

Sourcmr Arctic Lighterage Company, Kotzebue

B-4.4 displays the projected inbound and transshipped general commodity cargo through Kotzebue in the 1985-2000 period.

Construction Equipment and Materials. Kotzebue serves as a distribution center for waterborne shipments of most construction equipment and materials (except sand and gravel) destined for the NANA region. Approximately 57 percent of construction materials arriving at the Port of Kotzebue remain in the community, the remainder being transhipped to other destinations by either water or air. Table B-4.4 displays the projected volume of related construction equipment and materials through Kotzebue in the 1985-2000 period.

Mineral Production. Mining-related construction materials imports will depend upon the extent to which development of this resource industry is carried out in the next 20 years. The WAATS study forecasts as much as an additional 44,000 tons of construction materials, and equipment could be required in the 1985 to 1995 period for maximum mine development in the NANA region.

Furthermore, mine development would necessarily increase the import of refined fuels and general commodities to the affected communities or areas. Since the extent of future development in the regional area is uncertain at this time however, forecasts of resulting throughput at Kotzebue have not been included in Table 8-4.4.

Oil and Gas Development. Additional oil and gas development potential exists in the Chukchi Sea. The present offshore leasing schedule, together with the lead-time requirements for such development, indicate that any demand placed upon port facilities in Kotzebue would not occur until the 1990's or later. Until the nature and magnitude of the development potential is known, an assessment of throughput quantities cannot be made. Furthermore, it is possible that demands

Table E-4.4 WATERBORNE CARGO, KOTZEBUE - 1985 to 2000 (FORECAST)[1]
-Most Probable' Level-

INBOUND CARGO	1985	1990	1995	2000
Bulk Fuel	24,388	33,422	34,185	29,523
General Commodities	2,289	2,320	2,374	2,411
construction Materials	4,308	5,255	6.064	6,915
TOTAL	30,985	40,997	42,623	38,849

OUTBOUND (TRANSSHIPED) CARGO				
Bulk Fuel	8,953	10,938	13,220	12,128
General Commodities[2]	1,620	1,636	1,654	1,668
Construction Uaterials	122	443	720	1,012
TOTAL	41,680	54.014	58,217	53,657

1. Figures are in tons.
2. Includes only those general commodities transshiped by marine traneport

upon Kotzebue industries and the port may be limited to operational support only.

Summary. Table 8-4.4 displays the most possible level of throughput expected at the Port of Kotzebue. In the event that concentrated mineral development and oil and gas development and production were to materialize in the region, and cause the expected increases in population and economic activity, the throughput levels shown in the table could increase substantially. Based upon population forecasts reflecting a "high" level of growth (which assume heavy mining and oil and gas development in the region), throughput at the Kotzebue port could reach the levels shown in Table 8-4.5.

4.3 PROBLEMS AND FUTURE NEEDS

All waterborne commerce arrives by oceangoing vessels during the brief ice-free period. These shipments are transferred to shallow draft lightering barges and are brought 13 miles to the City dock. This operation is continually threatened by accreting sediments and migrating channels. The lighterage operation often is interrupted by storm induced drawdown of nearshore waters, and by large offshore waves. These conditions have been tolerated during past years, but increased economic activity at Kotzebue further exacerbates shipping problems.

Alteration of existing port functions is likely to occur from regional resource development. Petroleum and mining interests require large land based areas for storage and marshalling. Also, increased interaction with aircargo and shipping is predicted. Certainly, large resource development projects require that shipping interruptions are minimized.

Table B-4.5 WATERBORNE CARGO, KOTZEBUE - 1985 to 2000 (FORECAST)[1]
-"High" Level-

	1985	1990	1990	2000
INBOUND CARGO	32,550	45,246	49,417	47,359
OUTBOUND (TRANSSHIPPED) CARGO	11,235	14,366	18,079	18,037
TOTAL THROUGHPUT	43,785	99,612	67,496	65,356
Increased throughput 'expected due to mining and oil and gas development[2]	5.1%	10.4%	15.9%	21.8%

1. Figures are in tons
2. Compares throughput levels for "High" with "Moat Probable" Table B-4.4

Waterborne cargo delivered to populations along the Kobuk and Selawik Rivers must traverse Kobuk Lake. A transshipment port closer to these river mouths would aid delivery of supplies if the Kobuk Lake transport route can be replaced by a more efficient land transport system from a deepwater port.

The future port needs at Kotzebue are a deepwater berth that is protected from inclement wave conditions. The port's land area must be large enough to support necessary contiguous operations and storage. Adequate and safe land transportation routes must access the port area. A port site which allows adjacent airport development is preferred. Failure to implement improvements in Kotzebue's shipping capabilities will retard economic development in the region and will financially burden the area's residents.

5.0 PORT DESIGN CRITERIA

Criteria for port design are used as a basis for evaluating alternative sites and producing conceptual. port plans. The criteria are composed of both design standards and design constraints. Design standards relate to infrastructure and operational requirements, while design constraints relate to factors that limit implementation options.

5.1 DESIGN STANDARDS

The design standards for the Kotzebue deepdraft port project are based upon expected operational and functional requirements. The problems and future needs, as described in Section 4.3 are translated into engineering guidelines for preliminary port design. Specific design standards for the deepdraft port are presented in the following paragraphs.

Vessel Accommodation

General Cargo. Presently, the largest vessel that transports cargo to Kotzebue is an ocean-going barge having a capacity of approximately 16,000 deadweight tons (DWT). This class of barge has an approximate length of 400 ft. and a loaded draft of 22 ft. Smaller ocean-going barges (4,000 DWT) also call at Kotzebue, and these have lengths of about 230 ft. and loaded drafts of 16 ft. The ocean-going barges are towed by tugs with drafts between 12 and 16 ft.

Another vessel that transports general cargo to the western and arctic coasts of Alaska is the Bureau of Indian Affairs ship, North Star III. This Victory-class vessel is 455 ft. long and has a fully loaded draft of nearly 29 ft. The ship's capacity is just over 10,000 DWT. The North Star III is equipped with onboard landing craft for lightering cargo over the beach. This ship unloads cargo at many places prior to reaching Kotzebue, thereby reducing its draft requirements at this port.

Cargo from the previously described ocean-going barges is lightered onto smaller barges for transport to the existing dock at Kotzebue. These lighterage barges vary in length from 80 ft. to 160 ft. The largest of these has a capacity for nearly 1,000 DWT, but loading is limited to around 300 DWT to prevent the draft from exceeding a 7 ft. limitation imposed by the natural channel leading to the dock. A smaller barge (around 125 ft. long) has a capacity of 500 DWT fully loaded, and 200 DWT at a 7 ft. draft condition. The smallest barges (80 ft. long) have drafts of about 3 ft. and often are powered by large outboard engines, otherwise, tugs with drafts of approximately 3 to 6 ft. are used to maneuver the lighterage barges.

Fishing Craft. Development of a deepwater port at Kotzebue is expected to create demands for servicing and/or off-loading fishing craft. Vessels which comprise the fishing fleet vary in size from large inter-ocean ships to small boats used principally by local residents. The maximum draft of fishing craft that will call at Kotzebue is assumed to be 20 ft.

Petroleum Development. The exploration and eventual production of petroleum resources in the Chukchi Sea would be aided by an operations base at Kotzebue. Port development would enhance the effectiveness of such a base. Normally, offshore petroleum development involves workboats for transport of personnel, equipment, and other logistical services. These boats have lengths up to 150 ft. and loaded drafts between 10 and 15 ft.

Onshore Mining. Potential use of Kotzebue's deepdraft port for exporting the region's minerals and coal would create specialized berthing demands. Although these future bulk carriers cannot be described in detail, some general characteristics are probable. Minimum ship capacities are predicted to be about 40,000 DWT, and draft requirements could be 35 to 45 ft. Reinforced hulls are likely to be used to extend the shipping season.

Design Vessel. Presently, the largest vessel to call at Kotzebue is the ocean-going barge with a loaded draft of 22 ft. This also is the largest vessel which can be described accurately for future port needs. Although mining uses eventually may require deeper-draft vessels, port expansion to provide for these bulk carriers can await better definition of their design specifications.

The selected design vessel, therefore, is the oceangoing barge with length of 400 ft., beam of 100 ft., draft of 22 ft., and capacity of 16,000 DWT. The depth of water at the dock must exceed the vessel draft to allow for safety clearance, waves, and drawdown caused by unfavorable winds. A port depth of 30 ft. below mean-lower-low-water (MLLW) is recommended to adequately insure vessel safety and favorable operating conditions.

Protection Requirements

Both the port structure and berthed boats must be protected adequately from destructive forces of nature. During the planning phase of the port project, protection requirements can be analyzed more generally than during the design phase. Potentially destructive influences on the port's functional integrety must be identified and quantified in enough detail to properly determine optimum siting and engineering feasibility.

Design standards for port protection mostly derive from extreme oceanographic conditions. These extremes relate either to selected recurrence intervals or to absolute values, in accordance with accepted engineering practice. A description of general oceanographic conditions at Kotzebue appears in a previous report section. For planning phases, the design wave is estimated to be 15 ft. at the port's most seaward improvement. This significant wave height is calculated from observed maximum wave heights and from analysis of fetch and wind conditions expected to recur within a 50 year interval. The significant wave height normally is used instead of maximum wave height since experience demonstrates its sufficiency.

Alteration of Kotzebue Sound's still-water level by tides or by wind setup and setdown are important determinants of flooding potential and operational restrictions. Southerly of the shoals fronting Kotzebue, the maximum tidal range is estimated to be 3.5 ft., and the average diurnal tidal range is estimated to be 2.0 ft. Sea level changes due to wind force are selected as 6.0 ft. The port design is determined to require working and access surfaces at elevations at least 10 ft. above mean-lower-low-water (MLLW) to minimize flooding potential. These surfaces also require protection from wave action in excess of 1 or 2 ft. to alleviate flooding during an event of combined maximums for tidal and setup heights.

Sea ice creates design considerations in addition to shipping season limitations. The mass movement of ice can cause it to override and pile up at port structures. Port appurtenances must be capable of withstanding resultant forces. For planning purposes, the major port structure, the causeway, is expected to be more heavily impacted by wave forces than by ice forces.

Land Requirements

An analysis of potential port. operations and review of other facility development plans reveals that a parcel of approximately 120 acres should accommodate the present level of service as well as any anticipated growth in services. It is normally advantageous to acquire all land that ultimately may be required for the port operation. Private interests can be expected to develop facilities along the periphery of the port, making future acquisition of land much more costly. This land can be appropriately zoned and sold to private interests capable of developing port related facilities on the property.

The port layout must provide for the separation of discrete functions in an economical manner while assuring smooth traffic flow. The port uplands will be divided into a container terminal and marshalling yard, a staging area, and a storage area for break-bulk items and mineral concentrate. Transit sheds, warehouses, terminal building, field storage and distribution facilities, parking area, vessel storage, and other port administration and operation related facilities are also envisioned.

Associated Facilities

The utility network for Kotzebue would probably not be extended more than a few miles from the city. Accordingly, fuel, water, electricity, fire fighting. and communication services may have to be provided on-site. Navigational aids will be necessary. An unknown is whether or not a road will be built from Kotzebue, southerly along the entire length of Baldwin Peninsula (the Chicago Creek Road). Assuming the road is built, it will probably be necessary to construct a small spur road to a port facility remote from the city. It is also probable that facility operator housing must be provided at such a site.

Subport

The transshipment subport will require approximately 20 acres of land. As envisioned, the subport would be a relatively small facility of sufficient area to store and handle fuel, break-bulk cargo, and river barges and tugs, and to provide space for administrative buildings and vehicle parking. A small marshalling yard will be required. Some private sector facilities probably would be built to service the subport, and lease space would be provided for this purpose.

5.2 DESIGN CONSTRAINTS

Design constraints generally relate to environmental or geotechnical considerations. The public's paramount interest in preventing projects with unacceptable features or impacts causes most design constraints to be defined by law or government regulations. As such, construction of a deepwater port to serve the City of Kotzebue will require a variety of Federal and State regulatory permits. Permit application lead times will be significant considerations in planning and scheduling the complex sequence of survey, design, and construction activities required for project development.

Federal and State regulatory requirements which potentially apply to any Alaskan port construction project are shown in Table B-5.1. Most of these are probably applicable to construction of Kotzebue's port, but specific permits and stipulations will depend on design features and construction schedules submitted with permit applications for agency review.

TABLE B-5.

MAJOR REGULATORY REQUIREMENTS
FOR ALASKAN PORTS

REGULATORY REQUIREMENT	MINISTERING AGENCY	DESCRIPTION
Clean Water Act, Section 404: Discharge of Dredged or Fill Material into U.S. Waters	Corps of Engineers	Permit required for any dredged or fill material placed in U.S. waters, including wetlands.
Rivers and Harbors Act, Section 10: Structures or Work In or Affecting Navigable Waters	Corps of Engineers	Permit required for any work or placement of structures in U.S. waters.
National Environmental Policy Act: Environmental Impact Statement	Corps of Engineera	Granting of the above Section 404 and Section 10 pewits may be determined by the District Engineer to be a major Federal action which could significantly affect the human environment, thus warranting an EIS.
National Pollutant Discharge Elimination system (NPDES)	U.S. Environmental Protection Agency	Permit required for any activity or waste water system which discharges into a waterway.
Clean Air Act: Prevention of Significant Deterioration	U.S. Environmental Protection Agency	Pewit required for new-source discharge of air pollutants.
Oil Spill Prevention, Containment, .and Countermeasure (SPCC) Plans	U.S. Environmental Protection Agency	Plans required for port-related fuel storage and distribution facilities.

TABLE B-5.1 (cont'd)

REGULATORY REQUIREMENT	ADMINISTERING AGENCY	DESCRIPTION
Endangered Species Act	U.S. Fish and Wildlife Service	Requires review of project to determine any potential impact on endangered species (none anticipated).
Vegetative Mineral Material	U.S. Bureau of Land Management	Permit required for obtaining gravel, sand, or rock from public lands.
Fish and Wildlife Coordination Act	U.S. Fish and Wildlife Service; National Marine Fisheries Service	Both agencies will cooperate with the Corps of Engineers in Section 404 and Section 10 reviews.
Certificate of Consistency vith Alaska Coastal Management Program and Federal Coastal Zone Management Act .	Office of the Governor, Division of Policy Development and Planning	Review required for consistency determination. If no approved local program in effect, state of Alaska standards apply.
State 401 Water Quality Certificate of Reasonable Assurance	Alaska Department of Environmental Conservation	Certifies compliance with State of Alaska water quality standards during work, discharge of substances, or placement of structures in waters.
Air Quality Control Permit to Open Burn	Alaska Department of Environmental Conservation	Pewit required to burn debris, brush, litter, construction waste, etc.
Air Quality Control Permit to Operate	Alaska Department of Environmental Conservation	Pewit required to limit air contaminants.

TABLE B-5.1 (cont'd)

REGULATORY REQUIREMENT	ADMINISTERING AGENCY	DESCRIPTION
Permit to Interfere with Salmon Spawning Streams and Waters	Alaska Department of Environmental Conservation	Permit for any activity which may obstruct, divert, pollute, dam, barricade, conserve, impound, or render the waters inaccessible or uninhabitable for salmon.
Oil Discharge Contingency Plans	Alaska Department of Environmental Conservation	Plans required for storage facilities of 10,000 gallons or more of petroleum products.
Disposal of Hazardous waste	Alaska Department of Environmental Conservation	Permit required for disposal of any toxic or hazardous material.
Surface Oiling Permit	Alaska Department of Environmental Conservation	Permit required for oiling any roads at project.
Anadromous Fish Protection Permit	Alaska Department of Fish and Game	Permit required for any work in a listed anadromous fish river, lake, or stream.
Leasing of Lands Other Than for the Extraction of Natural Resources	Alaska Department of Natural Resources	Lease required for exclusive use of State-owned lands for a long- or short-term period. This also applies to tidelands and submerged lands.
Land Use Permit	Alaska Department of Natural Resources	Permit required for temporary non-exclusive use of State tidelands and uplands.

TABLE B-5.1 (cont'd)

REGULATORY REQUIREMENT	ADMINISTERING AGENCY	DESCRIPTION
flaterial Sale	Alaska Department of Natural Resources	Required to obtain rock, gravel, or sand from State land.
Permit for Bridges over Navigable Waters	U.8. Coast Guard	Permit required for building a temporary or permanent bridge or causeway over navigable waters.

6.0 ALTERNATIVE PORT SITES

Favorable deepwater port sites for serving Kotzebue must logically be on Baldwin Peninsula, since the port must be readily accessible from both land and water transportation routes. Three sites are identified on Baldwin Peninsula which allow comparison of general, as well as specific port siting characteristics. The alternative deepwater port sites are shown in Figure B-6.1, and are labeled as 1) City Site, 2) Cape Blossom Site, and 3) Isthmus Site.

These three general sites are selected because each exhibits unique attributes while retaining some potential for best satisfying Kotzebue's future port requirements. The City Site offers opportunities to retain close proximity to existing port users and maximum use of present facilities. The Cape Blossom Site appears to be the closest area to Kotzebue with unrestricted access to deepwater. The Isthmus Site has potentially reasonable access to deepwater and offers the best opportunity for development of a nearby transshipment facility (subport) on Kobuk Lake.

.Descriptions of each site's capability to fulfill prescribed design criteria are provided in the following report sections. These sections are followed by a summary comparison of site advantages and disadvantages.

6.1 DEEPWATER PORT AT CITY

To accommodate the design vessel with 22 ft. draft, a causeway or dredged channel must extend westerly from the existing city dock, see Figure B-6.2, to some point about 13 miles offshore. The existing land facilities (see Photos 1 and 2) are capable of supporting present needs but are insufficient for projected demands. Based upon previous studies, suitable expansion areas art? unavailable (Ref. 50). Adjacent land is used for residential, business, and other urban purposes.

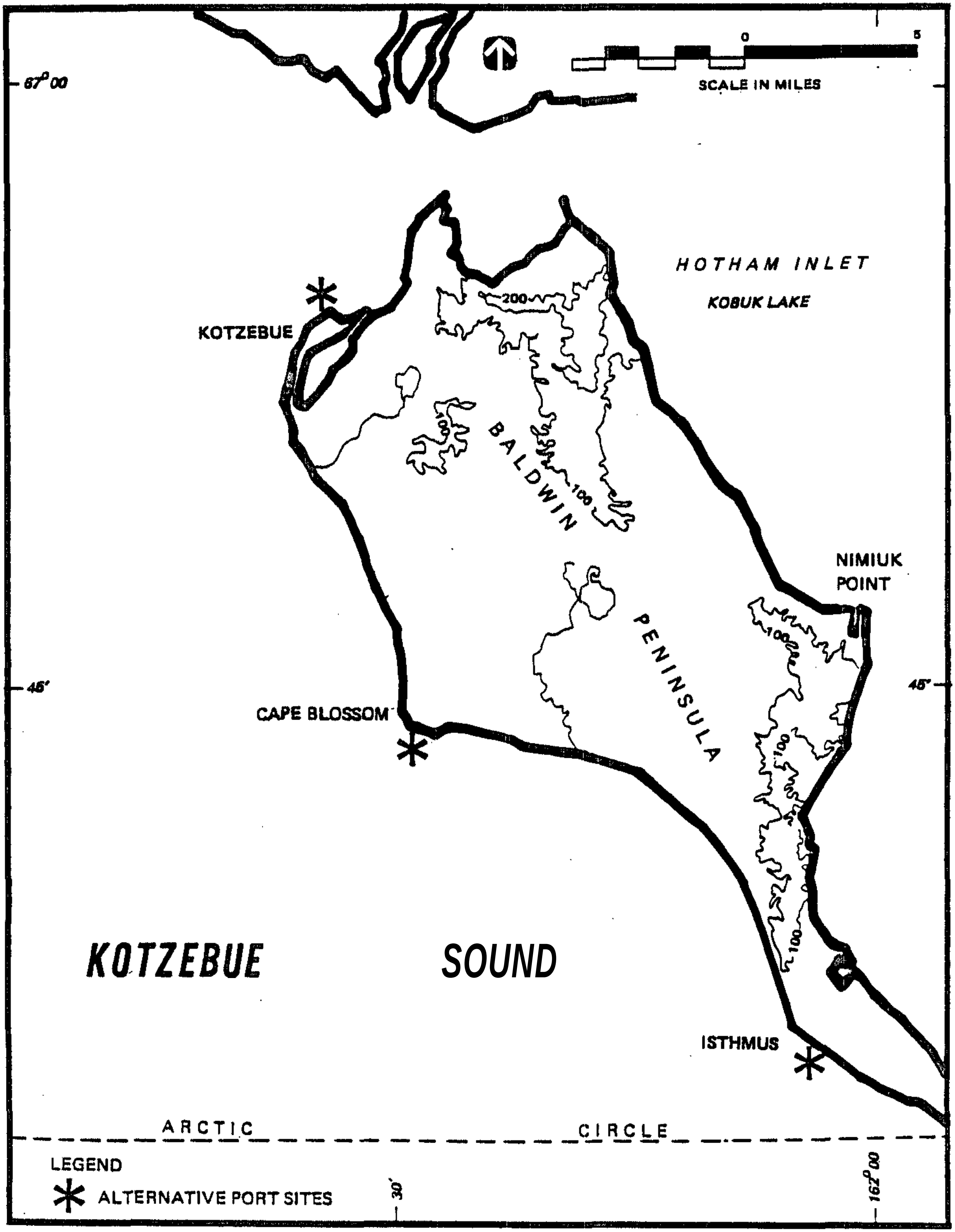


FIGURE B-6.1 POTENTIAL DEEPWATER PORT SITES FOR KOTZEBUE

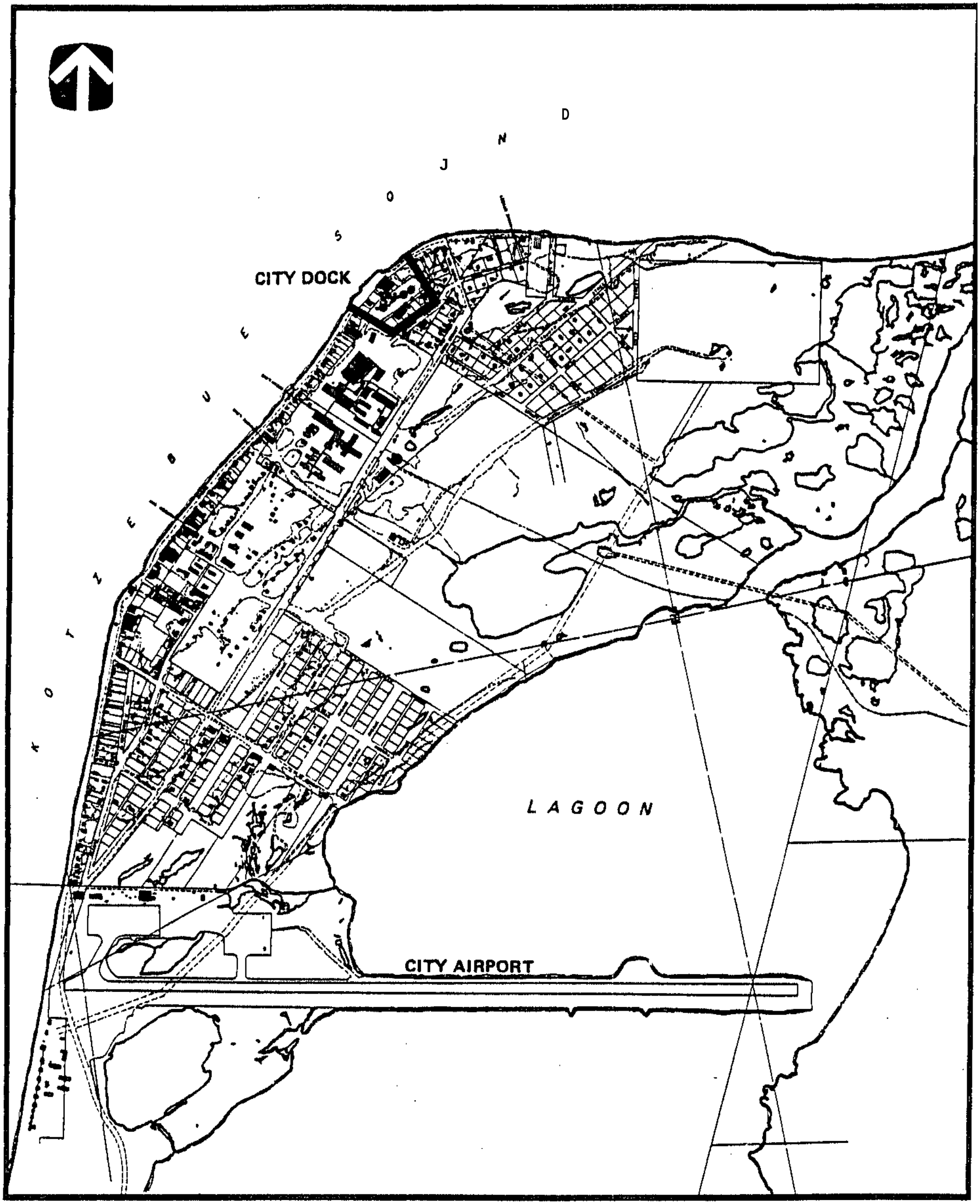


FIGURE B-6.2 EXISTING PORT/AIRPORT LAYOUT

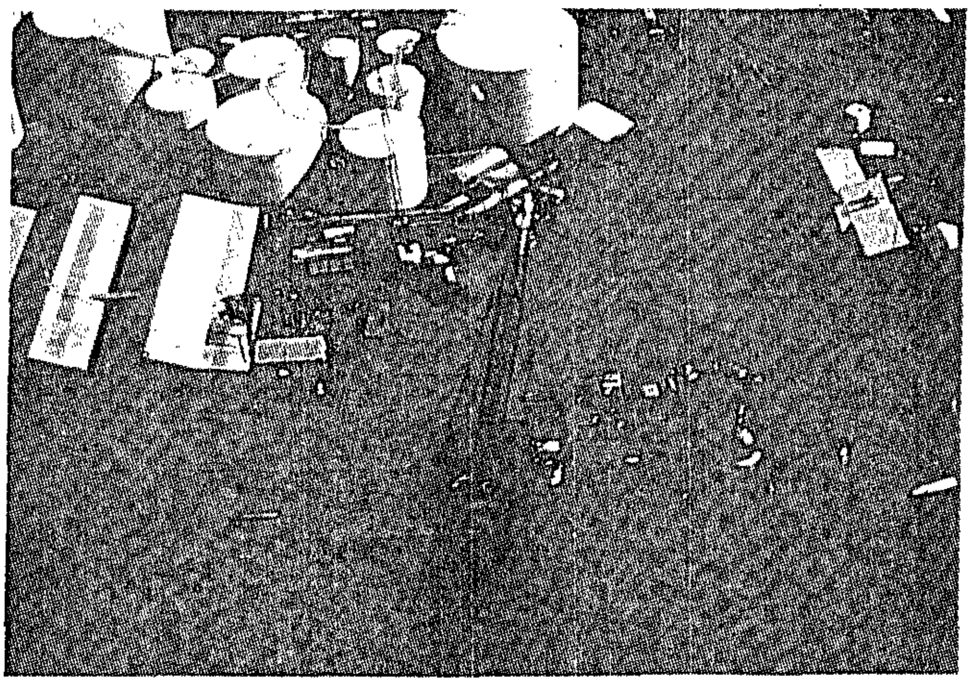


PHOTO 1 - AERIAL VIEW OF KOTZEBUE'S DOCK AREA

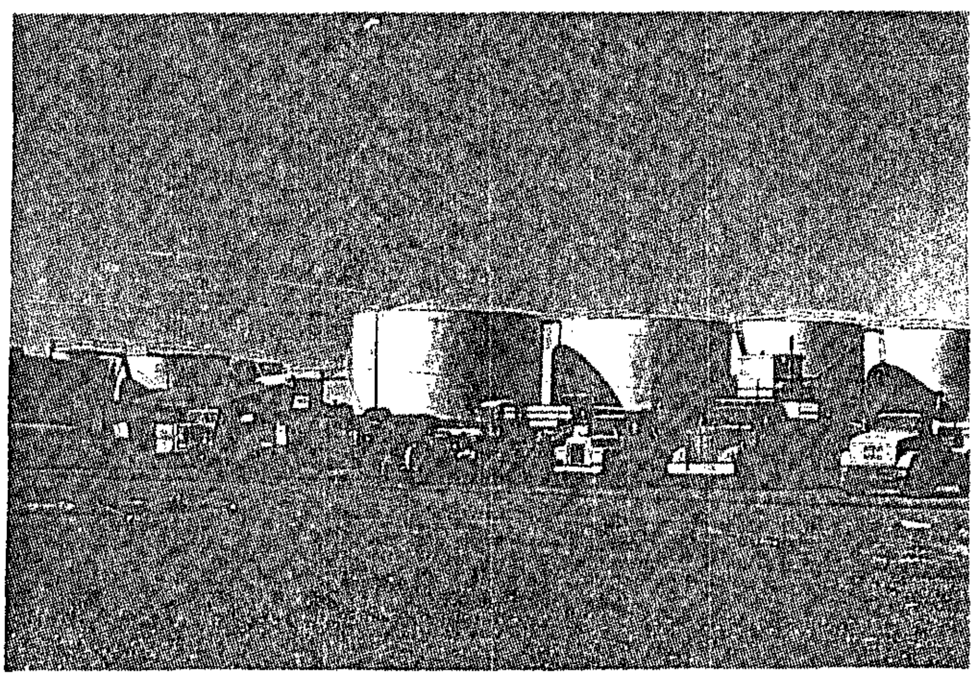


PHOTO 2 - EXISTING PORT EQUIPMENT & STORAGE

The City port area is located on lands that are fairly well protected from flooding. Only the dock and marshalling area are in the 100-year flood plain.

The large tank farm for bulk petroleum storage is a safety concern to adjacent land users. A large, uncontrolled fire would be catastrophic to the City. However, the port facilities are convenient to businesses and residents and to security and patrolling efforts.

Developing a deepwater port within the City wouls impinge upon social and biological values. A principal concern is potential adverse impacts upon salmon migrations and subsistence fishing. Either a causeway or dredging activity at this location near the entrance to Hotham Inlet, and subsequently the Noatak, Kobuk, and Selawik Rivers, might inhibit successful fish migration. The causeway diverts fish offshore, and dredging creates turbidity and noise. Dredging is predicted to occur annually for maintaining project depths.

The Kotzebue airport is located nearby and interacts well with the port site. However, the connecting route runs through the City causing some traffic problems. The potential for airport expansion or nearby relocation is presented in Section 8.0. The potential for developing an interactive subport for transshipment purposes is presented in Section 6.5.

6.2 DEEPWATER PORT AT CAPE BLOSSOM

From Cape Blossom, the shoreline runs northerly to Kotzebue and easterly towards the Baldwin Peninsula isthmus. To the west of Cape Blossom, far offshore depths remain less than 20 feet, apparently representing the southerly limit of an expansive subsea delta extending from Hotham Inlet. To the

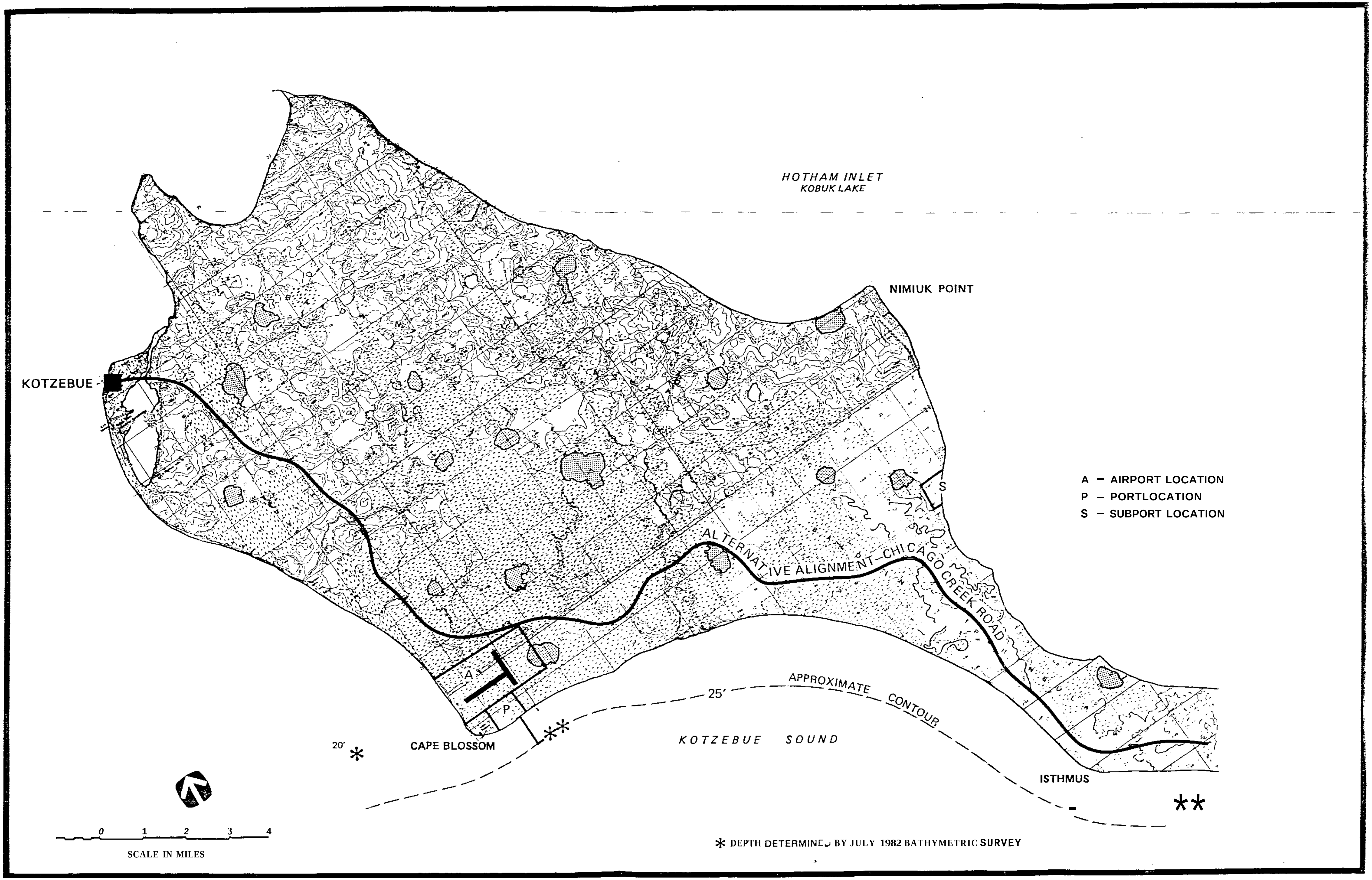


FIGURE B–6.3 CAPE BLOSSOM SITE

south of Cape Blossom, the sea bottom is gently sloping with no apparent channeling. Depths of 30 feet occur about 6400 feet from shore.

The most feasible offshore port configuration may be a causeway extending southerly to a 25-foot water depth with an immediate (or future) dredged access channel of 30-foot depth (see Figure B-6.3). By this method, the causeway length would be reduced to about 4000 feet, and little maintenance dredging would be expected due to the channel's offshore distance and depth.

Although littoral drift (the movement of sediments by nearshore waters) is predominantly to the north along Baldwin Peninsula, there are suspicions that sediments arriving from the south of Cape Blossom are diverted offshore by the projecting land form. This minimizes the causeway's potential erosional effects, since the port structure only exaggerates a natural condition.

The land form at Cape Blossom is distinguished by a prominent hill, about 130 feet high (see Photos 3 and 4). The shoreline running to the east of Cape Blossom is characterized by high bluffs receeding gradually to heights of only a few feet (see Photos 5 and 6). The bluff disappears completely about 1½ miles easterly of Cape Blossom, where a stream area with limited gravel deposits is evident.

Much more than 120 acres of gently sloping uplands is available for onshore port development. Seaward access to the land is possible over bluffs of about 15 foot height, Therefore, the land is protected from flooding and is oriented for good drainage. Facility sitings can be set well back from the bluff face. A schematic layout is presented in Figure B-6.4.

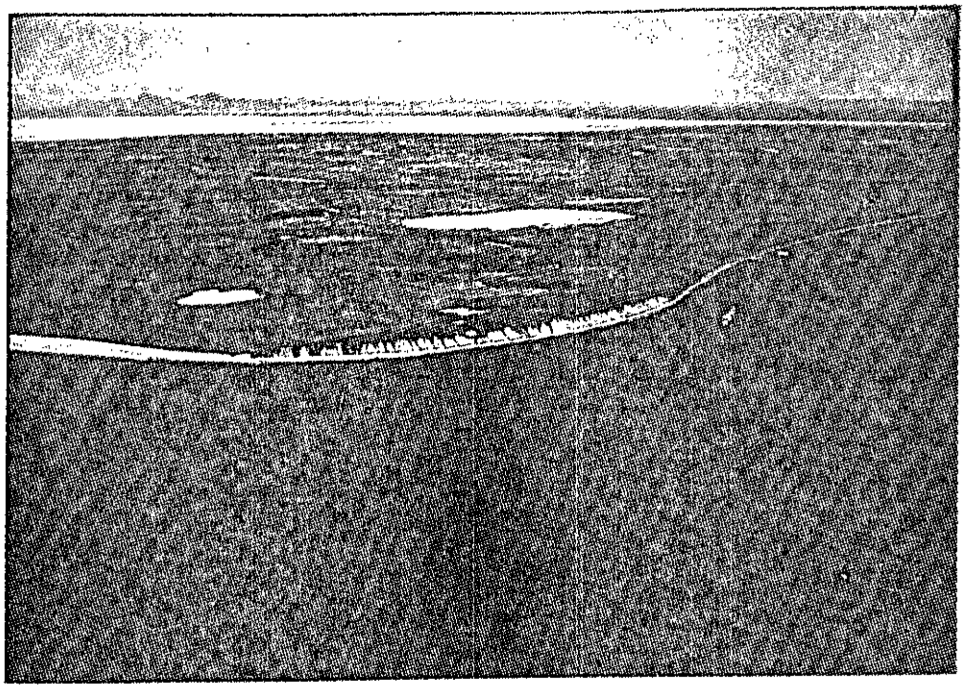


PHOTO 3 . CAPE BLOSSOM FROM WESTWARD SIDE

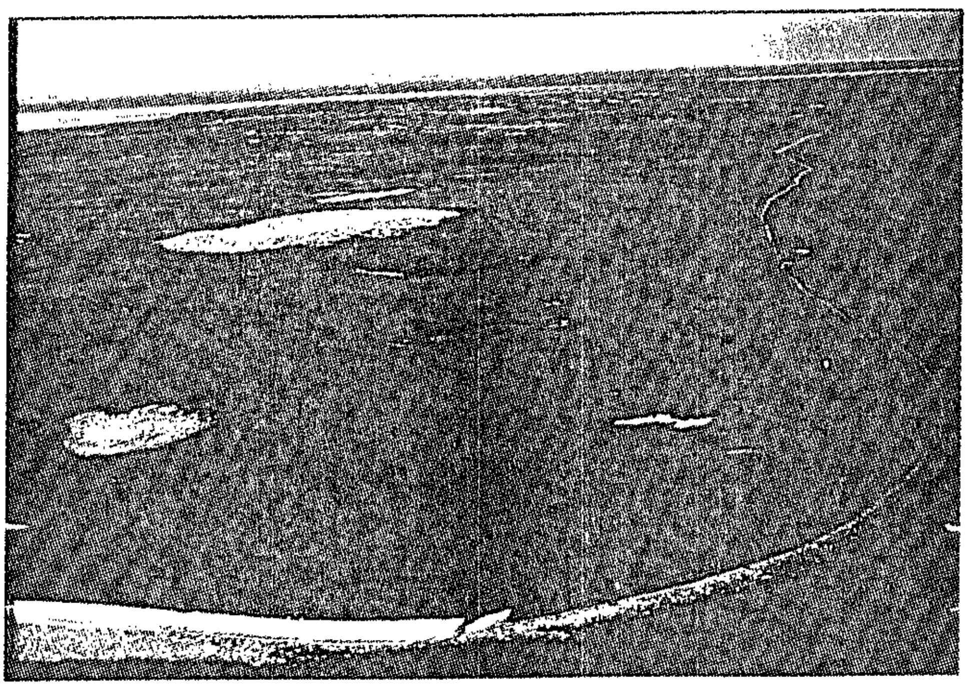


PHOTO 4 -CAPE BLOSSOM FROM NORTHWARD SIDE

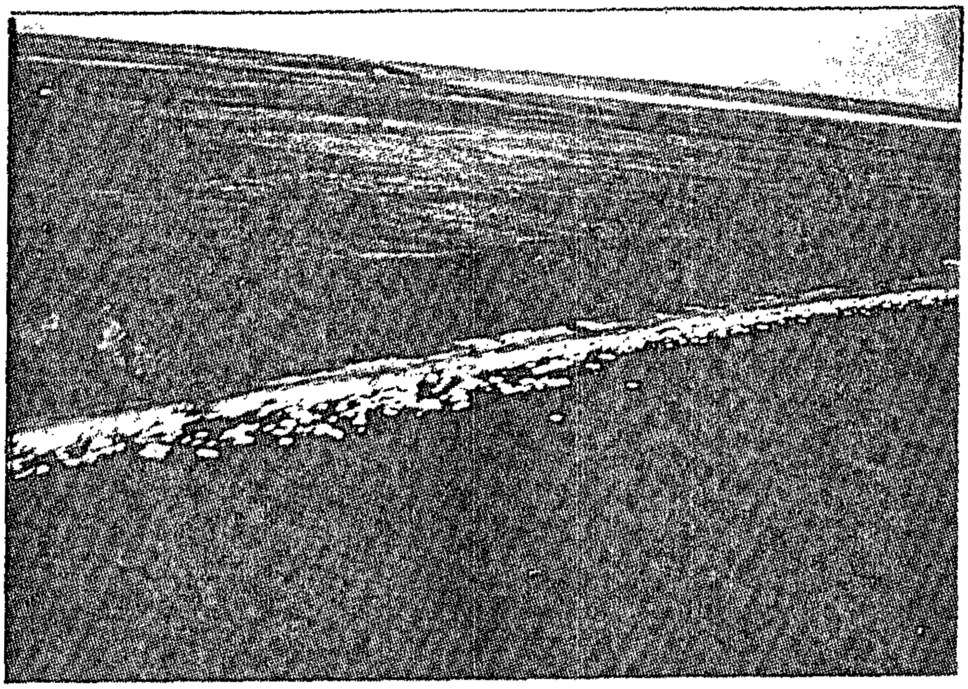


PHOTO 5 - BLUFFS ALONG SOUTHERN CAPE BLOSSOM

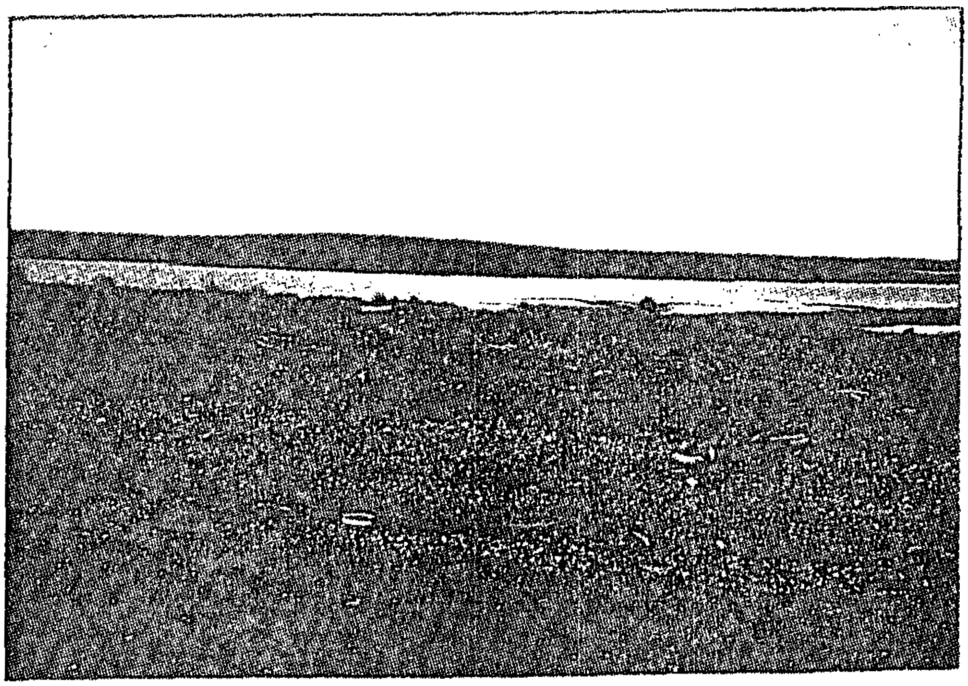


PHOTO 6 -GRAVEL DEPOSITS EASTERLY OF CAPE BLOSSOM

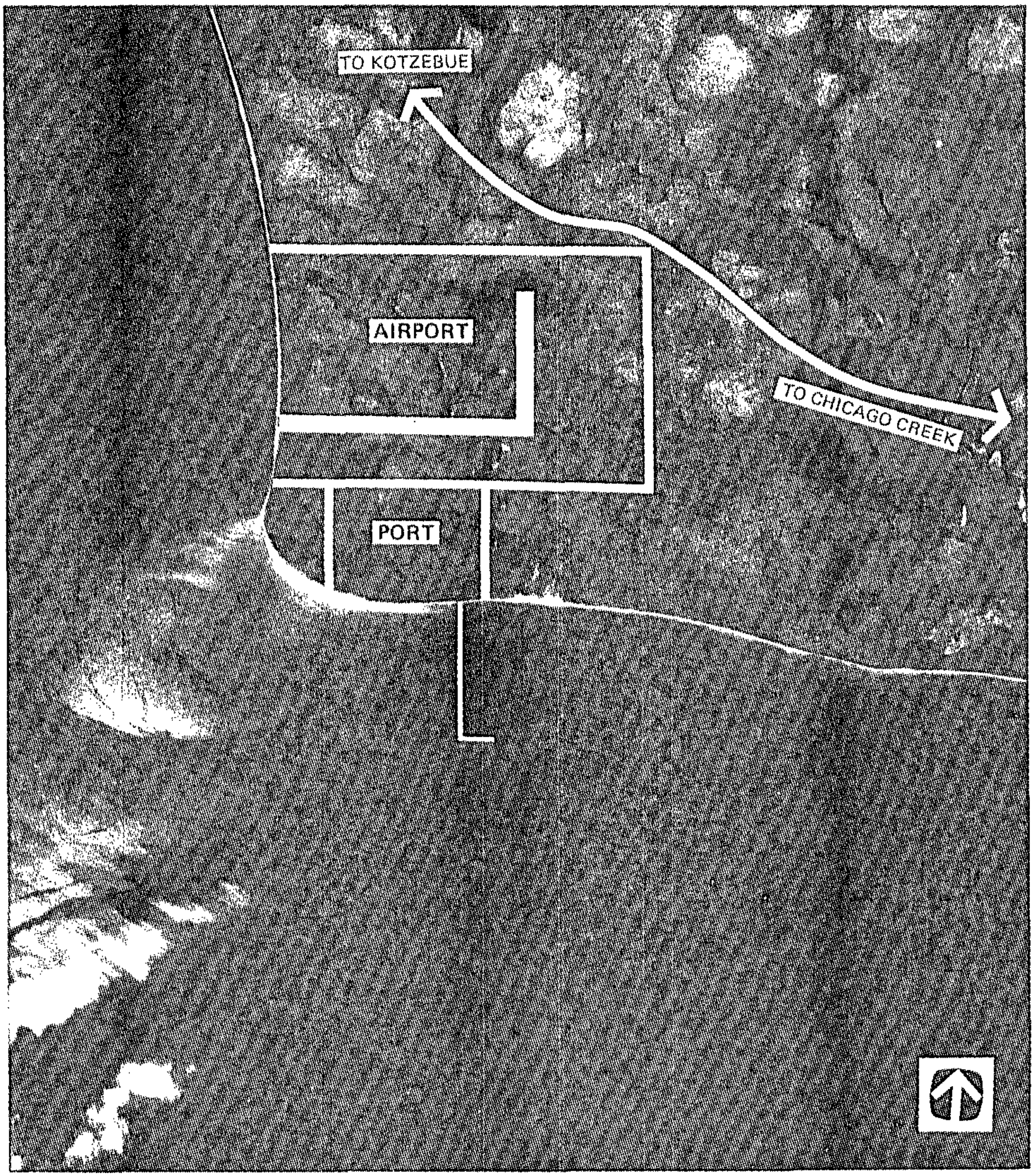


FIGURE B-6.4 CAPE BLOSSOM SITE, SCHEMATIC LAYOUT

Road construction is required between Kotzebue and Cape Blossom. As depicted in Figure B-6.3, one alternative alignment for the Chicago Creek Road passes close to Cape Blossom. The distance between Kotzebue and Cape Blossom is approximately 12 miles.

Land ownership at Cape Blossom is confused by multiple claims. Review of property status records and other available land status information shows that lands around Cape Blossom have been selected by either the Kikitagruk Inupiat Corporation (KIC) or NANA. The township north of Cape Blossom has been top filed by the State of Alaska. The subport site associated with Cape Blossom has been selected by KIC.

Some environmental concerns are associated with a port development at Cape Blossom. Impacts upon Arctic Char are possible since they migrate close along shore. However, the causeway would be remote from spawning streams and natural access channels to such streams. Seals are hunted in this area for subsistence. Potential impacts are unknown, but seem to be minimal. Likewise, birds utilize the Cape Blossom area, but the habitat value is neither unique or rare for Baldwin Peninsula. Cape Blossom does not appear to be a particularly valuable site for reindeer herding or feeding.

Adequate and suitable lands for airport development are available adjacent to the port site. Descriptions of potential airport development are contained in report Section 8.0.

If a deepwater port is located at Cape Blossom, a transshipment subport on Kobuk Lake is possible about 12 miles easterly of the deepwater port. This distance, and other characteristics of such a subport, are further detailed in report Section 6.5.

6.3 DEEPWATER PORT AT ISTHMUS

The Kotzebue Sound shoreline at the Isthmus Site generally is oriented along a northwest-southeast axis. Offshore depths gradually increase to 30 feet at a distance of approximately 7600 feet from the beach. No natyral channels or sand bars appear to be present. Northerly flowing littoral drift predominates at the isthmus. The shoreline appears to be eroding as a result of spalling, wave action, ice abrasion, and overland drainage.

A deepwater port can be developed at the Isthmus by constructing a causeway westerly 6000 feet to a water depth of 25 feet (see Figure B-6.5). The port's design depth of 30 feet then can be attained by dredging a channel to the dock. The north side of the causeway would be exposed to large waves, but the south side would experience waves of diminished height and frequency. The causeway would tend to accelerate erosion on northerly shores for a distance of about 3 miles.

Onshore lands have rather irregular gradients and quickly rise to elevations of 50 to 100 feet (see Photos 7 and 8). Sufficient areas are available for land based facilities, but seaward access (especially for loaded vehicles) is hampered by high bluffs. A schematic layout of the port site is shown in Figure B-6.6.

The lands in the isthmus area have been selected by KIC with NANA and the State each having top filed.

An access route between the Isthmus Site and Kotzebue requires a road length greater than 24 miles. All alternative alignments of the Chicago Creek Road traverse the isthmus area. One of the alignments has been depicted in Figure B-6.5.

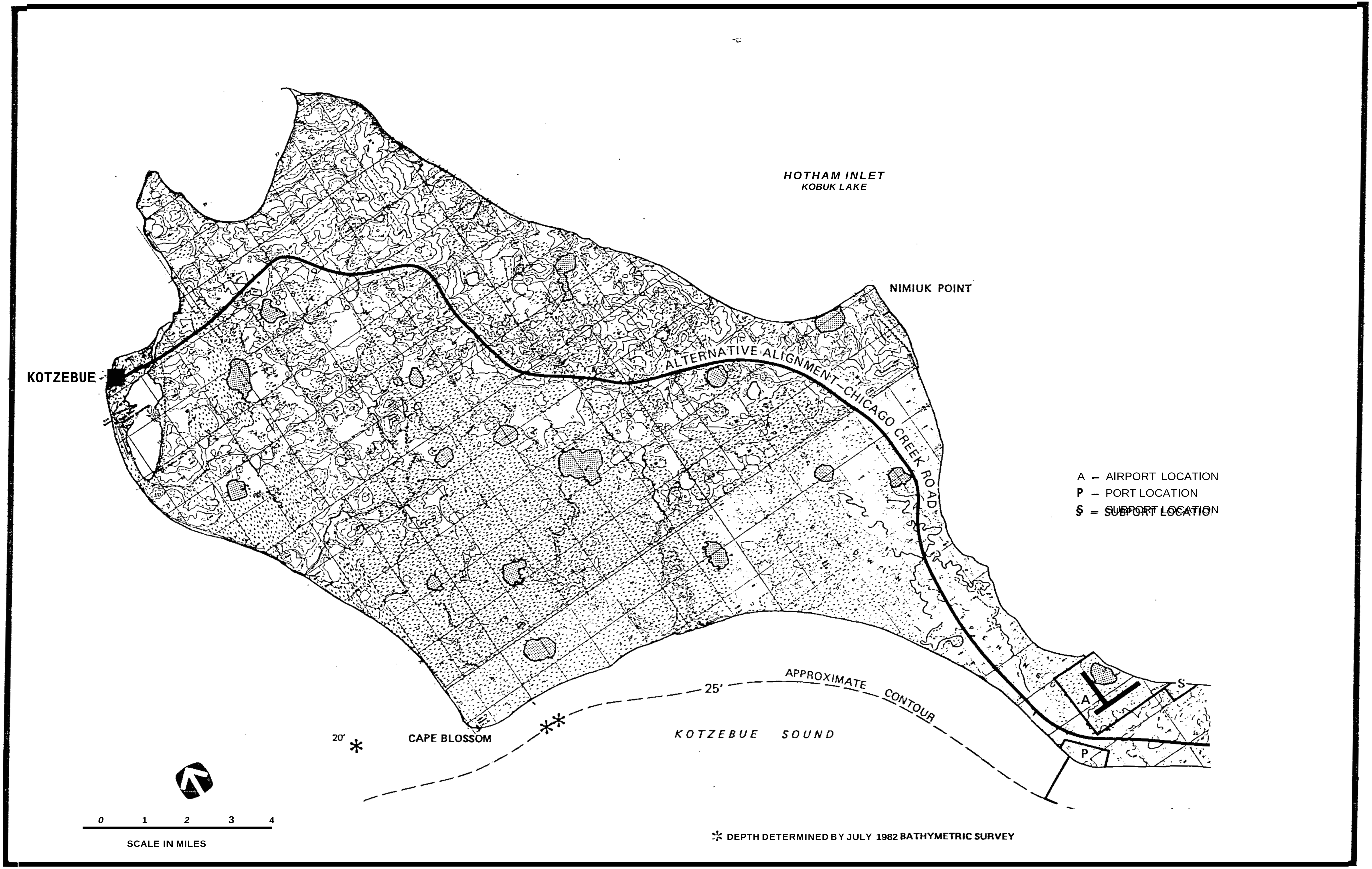


FIGURE B-6.5 ISTHMUS SITE

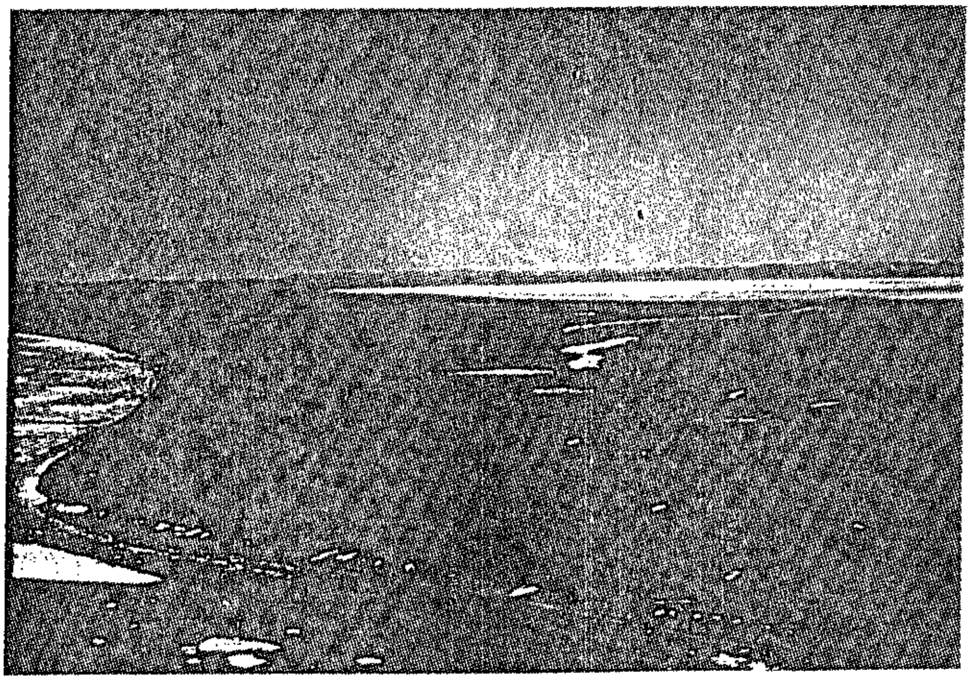


PHOTO 7 - AERIAL VIEW OF ISTHMUS

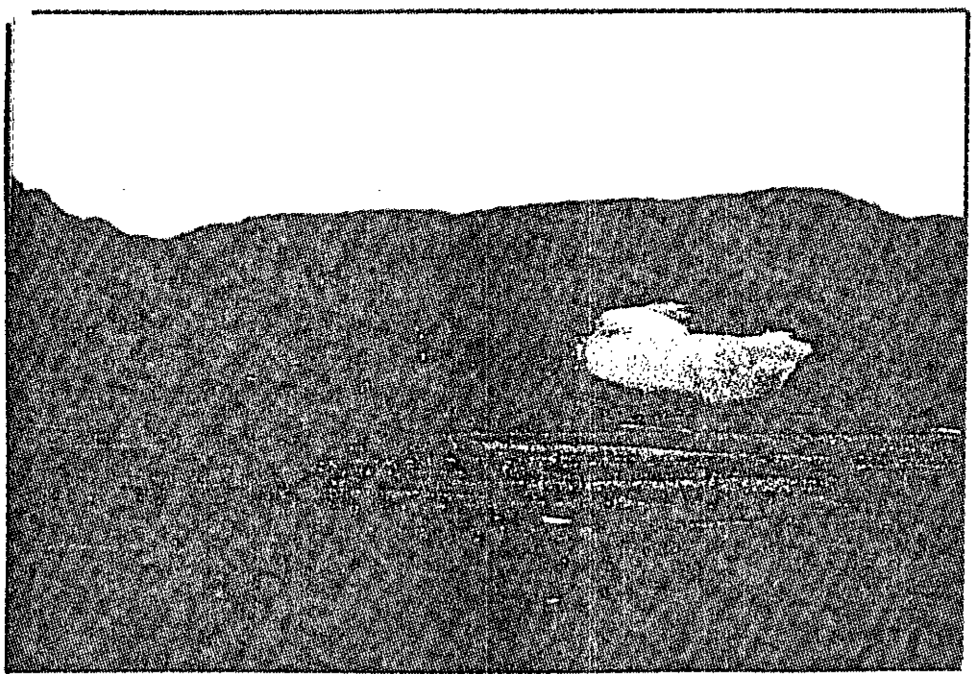


PHOTO 8 - SHORELINE BLUFFS AT ISTHMUS

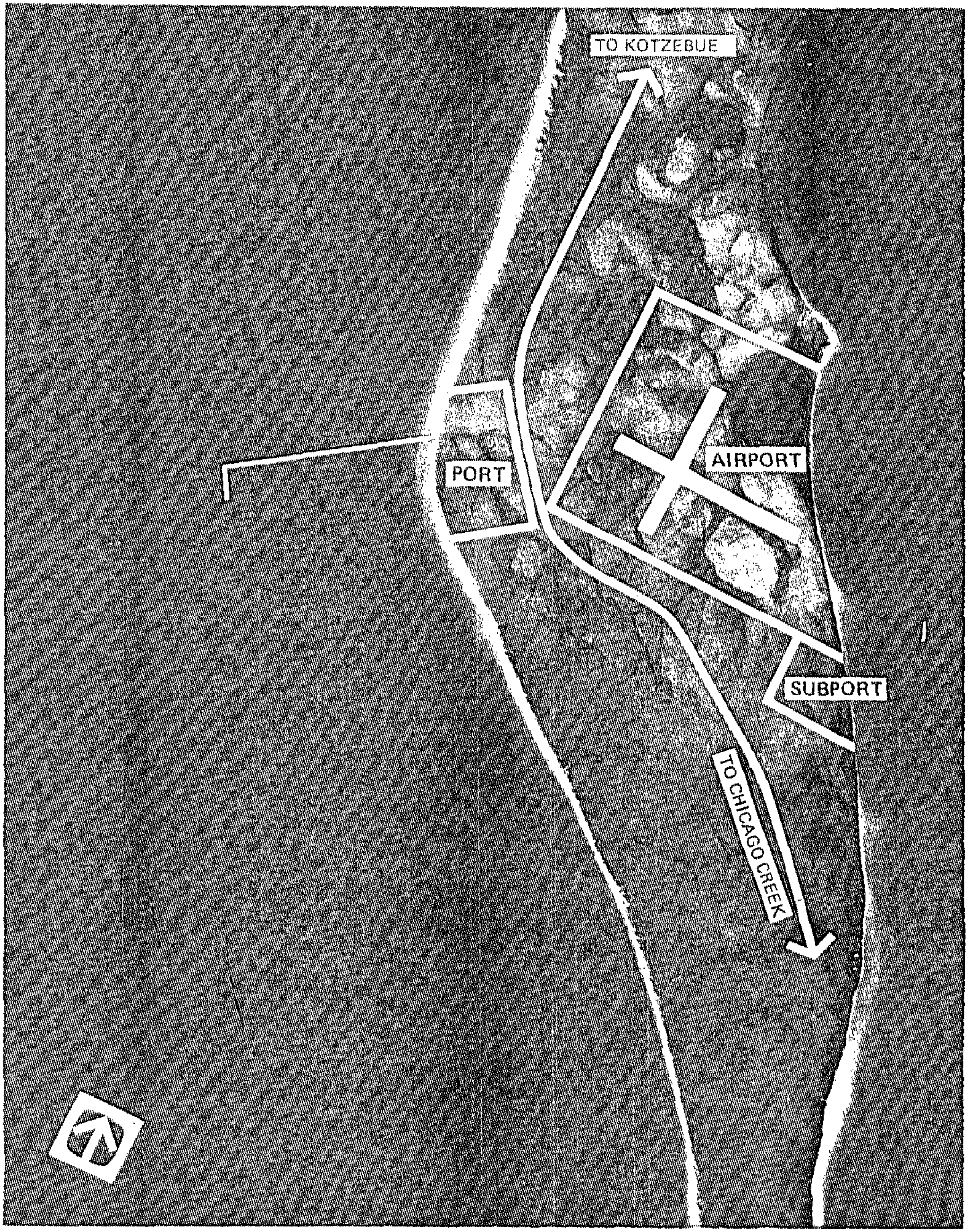


FIGURE B-6.6 ISTHMUS SITE. SCHEMATIC LAYOUT

No severe impacts upon fish, marine mammels, or birds are expected from port development at the Isthmus Site. The causeway's physical projection from the shoreline seems to induce potential impacts on longshore fish migrations, but the habitat area is not critical at this Baldwin Peninsula location.

Sufficient areas are located nearby for potential development of an airport and Kobuk Lake subport. Both of these facilities are described within other report sections.

6.4 COMPARISON OF DEEPWATER PORT SITES

Comparing offshore characteristics, the Cape Blossom Site has clear advantages. Shipping access to the 30 foot depth is within 6400 feet of shore, compared to 7600 feet at the Isthmus Site, and 13 miles at the City Site. Unlike other sites, Cape Blossom also appears to have substantially less impact upon littoral drift and erosion potential.

The land form at Cape Blossom is quite conducive to development. The topography exhibits gentle slopes and convenient seaward access, while avoiding flood potential. Land at the Isthmus Site seems too high for operational advantage. Land within the City of Kotzebue is not available in sufficient parcel size.

The City Site is adjacent to the principal users of the port, while Cape Blossom is 12 miles from Kotzebue, and the Isthmus Site is more than 24 miles from Kotzebue. Access roads are possible for either site.

Environmental impacts seem most adverse at the City Site; primarily because it is adjacent to the Hotham Inlet entrance to Kotzebue Sound. Fish migrations may be further impaired by the extremely long causeway length. No unacceptable impacts are predicted at the Cape Blossom or Isthmus Sites.

The Isthmus Site certainly has the best proximity to potential development of a Kobuk Lake subport. All three sites can accommodate nearby airport development, although the City Site requires a cross-town connection road.

6.5 SUBPORT FACILITY SIT'ING

Approximately 25 percent of all cargo arriving at the Kotzebue Port is transshipped to outlying villages. Approximately 71 percent of the cargo is liquid fuel (Ref. 7). Arctic Lighterage owns and operates the Kotzebue Port and barges transshipped cargo to outlying villages. If the subport were relocated, it would probably function much like the present facility. Preferrably, the site would be closer to the villages than the present site and have sufficient draft to accommodate river barges, be accessible by road, and be secure. Detailed evaluations of the site would be required prior to selection of an exact location for the subport.

Existing Port/Subport. The facility now being used as a port/subport is the city dock located in Kotzebue. Cargo is transshipped using cranes, forklifts, and other equipment. River barges are not restrained by the shallow depths at the dock. The facility is located adjacent to developed land which has a very mixed use, ranging from industrial to residential. The site is of limited size and expansion would be difficult and costly. Use of the port on a day to day basis by residents appears to be minimal. At the present level of activity, the port/subport does not cause excessive disruption, except possibly at peak offloading times. The present facility is fairly easy to secure and monitor as the Arctic Lighterage offices are immediately adjacent to the port.

Cape Blossom Subport. The subport located on the Kobuk Lake side of Baldwin Peninsula, which has been identified for possible development in conjunction with the Cape Blossom port is probably accessible by water although no field verification has been made (see Figures B-6.3 and 6.4). The distance separating the port and subport would be about 12 miles along a presently roadless corridor. The land distance to the villages along the inland rivers would be considerably reduced by a subport at this location. Residents of river villages who come downriver to pick up goods would probably not find that the proximity of the subport to the village a great advantage, as they generally would come to Kotzebue anyway. The identified site is close to at least one alternative alignment of the Kotzebue to Chicago Creek road being studied by DOT & PF. The surrounding land is undeveloped.

The site is not constricted by surrounding developments and could be built relatively quickly. Some businesses may be attracted to the area by development. The remote location of the site would cause a major security problem. The site does not appear to have any unique or serious environmental problems.

Isthmus Subport. The subport identified for possible development in conjunction with a port and airport at the narrow portion of Baldwin Peninsula provides an opportunity to combine several transportation functions in one area (see Figures B-6.5 and 6.6). The overriding concern of a development at this site is the distance to Kotzebue. However, the site is fairly close to inland villages. It is probable that a site with sufficient water depths can be found in the area identified. The land has been native selected and use of the site as a subport is probably not incompatible since the area is undeveloped and used primarily for subsistence purposes. The site could readily accommodate a subport and could be readily expanded if required. The existence of a subport, in conjunction with the port and airport would probably attract business and industry. Due to its great distance from Kotzebue, it is probable that a new satellite community might develop in the area. Since the subport would probably be constructed in coordination with the port and airport, sufficient activity may be generated in the area to minimize security problems normally associated with a development in a remote location. No unusual environmental problems have been identified at this site.

Site Comparison. The City dock currently serves as a port and subport. It is located in Kotzebue and is close to the airport. The alternate sites are much further from Kotzebue but are closer to the upriver villages. A major function of the subport is the handling of fuel. At the Isthmus Site, fuel could be readily transferred from an oceangoing barge to a river barge via a short pipeline. Pipeline construction from Cape Blossom to the identified subport site would be costly. While site capacity is limited at the present site, it appears that the City dock can handle the normal volume of cargo to the villages for several years to come. The alternate sites could readily accommodate any desired level of expansion. A subport alone would probably not create major economic development opportunities. An isolated subport, such as the Cape Blossom alternative would be very difficult to secure.

6.6 Kivalina Port Siting Effects

With the increase in value in nearly all minerals in the past several years, interest in mineral development has increased. Limited gold dredging operations are now underway in the hills surrounding Candle, formerly a major gold producing area. Two major mineral districts, the Shungnak and the Ked Dog/Lik districts, have emerged in the area.

The Shungnak District is estimated to contain $9 billion worth of copper, lead, zinc:, silver, and gold (at 1980 prices). The only recent activity in the area has been exploratory. High operating and transportation costs and rights-of-way and access difficulties have hampered mineral development in the area.

The Rea Dog/Lik district, in the Delony Mountains 85 miles northeast of Kivalina, shows promise of actual development beginning in 1983. Massive deposits of lead, zinc, and silver, along with barite deposits, are present. Cominco-American Ltd., General Crude Oil, and NANA Development Corporation have the principal mineral interests in the district; it is believed NANA will move to develop these resources.

Given the likelihood of increased shipping traffic as a result of mineral development activities at Red Dog, port alternatives near Kivalina are being seriously scrutinized (see Figure 8-6.7). The selected site will be developed as an industrial port serving the mining company and its personnel. Project planning is apparently well underway, ana it appears that a mining port at Kivalina will be completed before a general cargo port near Kotzebue.

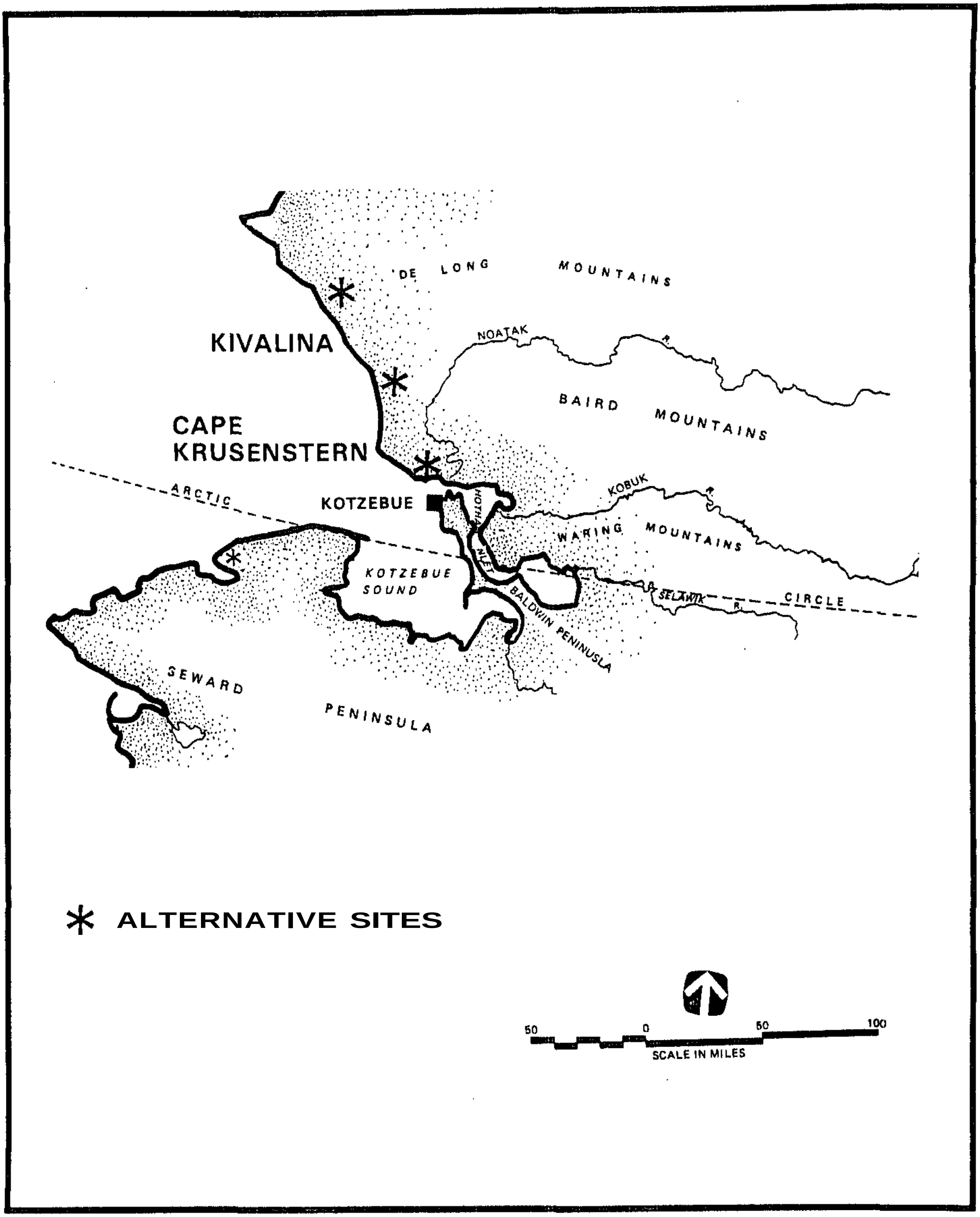


FIGURE B-6.7 COMINCO/NANA MINING PORT PROJECT

One way the port facility at Kivalina could be financed is through the use of industrial development revenue bonds. The chief benefit of using industrial development revenue bonds is that, if the financing meets the requirements of the Internal Revenue Code of 1954, as amended (the "Code"), the interest received on these bonds is tax-exempt to the bond-holders. Consequently, the entity for whom the bonds were issued generally pays a lower rate of interest on the bonds used to finance the project. Under the Code, the bonds must be issued by a state or political subdivision or on behalf of a state or political subdivision. Some of the possible entities for issuing bonds with respect to a port facility at Kivalina may be the village of Kivalina, the City' of Kotzebue, or eitner entity in partnership with NANA Regional Corporation.

In order for the Kivalina facilities to qualify for the issuance of tax-exempt industrial development bonds, the facilities would have to constitute an "exempt facility" under the terms of the Code. Docks and wharves fall within the Code definition of exempt facilities. However, the Internal Revenue Service also requires that tnese docks and wharves must be for general puhlic use. In order to qualify under this definition of "general public use," the facilities must be (1) open to the general. public or (2) open to use by common carriers or by charter carriers serving the general public or (3) part of a public port. Although the dock facility would be built primarily for Cominco/NANA for use in relation to its mining operations at Red Dog, this would not necessarily prevent the issuance of tax-exempt industrial development bonds for the facility. If this were a private dock or wharf, and were owned by or leased to or served only Cominco, it would not qualify as a facility for general public use. However, regulations and rulings from the

Internal Revenue Service have concluded that the public use test is met where a facility, even one owned by or leased to a specific "nonexempt person," qualifies for tax-exempt status if this person either directly serves the general public, such as a common passenger carrier or freight carrier, or if it is operated by a nonexempt person for general public use, such as a dock or wharf which is part of a public port.

A possible option under consideration by the mine development company is to make unutilized lighters available for coastwise service to Kotzebue, when they are not actually transferring ore to deep water carriers. Proposed vessels would be about 7,500 DWT and could berth at the existing port. Two such barges and two tugs would be available for about 50 of the possible shipping days. This option would no longer exist after 5-years due to project needs.

In addition, property "functionally related and subordinate" to the exempt facility may qualify, if it is of a character and size in relation to the character and size of the exempt facility. Once it is determined that the major facility is an exempt facility, functionally related and subordinate facilities might also qualify. This would be an inducement to other individuals to establish such related facilities. For example, if there is a dock or wharf that constitutes an exempt facility, equipment needed to receive and discharge cargo and passengers, such as cranes and conveyors, and related storage, handling, office and passenger areas, may also be able to be financed through the use of tax-exempt industrial development bonds. If the port is not a public port, but is a specific facility constructed for a specific company, it may still qualify for tax-exempt bond financing if it serves other users besides the company.

Port development at Kivalina may have only a minor impact on the deepwater port near Kotzebue. The Kivalina port, as presently planned, will be fairly self-contained and will also include a runway. Its primary effect will be to stimulate the Kotzebue cash economy, which may have the effects of increasing port throughput at Kotzebue.

The mining port at Kivalina would not be situated to be of significant value to potential shipping increases resulting from coal development on Chicago Creek, nor would it be likely to receive much increase in traffic as a result of future increased oil exploration activities in the Chukchi Sea. The deep-water port near Kotzebue, on the other hand, would probably receive such increases in traffic.

7.0 PORT SITING CONCLUSIONS

7.1 DEEPWATER PORT

Previous comparisons of the three alternative deepwater port sites (City Site, Cape Blossom Site, and Isthmus Site) revealssignificant differences in functional attributes and feasibility potential. A review of each site's unique characteristics quickly reveals the overall advantage of the Cape Blossom Site. The pertinent differences between alternative sites is summarized in Table B-7.1.

The Cape Blossom Site's chief advantage is its closeness to deep water, while retaining a functional proximity to the City of Kotzebue. The reduced offshore structural requirements translate directly to construction cost savings (see Appendix D). The Cape Blossom Site rates as well as, or better than, other port sites in all other categories except passenger convenience for airport development and port/subport interaction. Specific siting conclusions for the airport and subport developments follow this report section.

There is no apparent physical, social, or environmental barrier to deepwater port development at Cape Blossom. Based upon local coordination and public input, the Cape Blossom Site is acceptable to regional entities.

Since the Cape Blossom Site most effectively fulfills design criteria, it has been selected as the best location to develop a deepwater port.

7.2 SUBPORT FACILITY

The siting analysis considered a large number of criteria related to subport operations and design. Each alternative site has important advantages and disadvantages. Alternatives other than the present dock are distant from the City,

TABLE B-7.1

SUMMARY COMPARISON OF PORT SITES

EVALUATION FACTORS	CITY	CAPE BLOSSOM	ISTHMUS
FUNCTION			
Distance to Deepwater	13 Miles	4000 Ft.	6000 Ft.
Distance to Kotzebue	0 Miles	12 Miles	24 Miles
Land Size	6 Acres	120 Acres	120 Acres
Erosion Impacts	ery Adverse	Minimal	Adverse
ECONOMICS*			
Construction costs	Highest	Lowest	Middle
Maintenance costs	Highest	Lowest	Middle
SOCIAL			
Adjacent Land Use	Incompatible	Compatible	Compatible
Land Ownership	Multi-private	Native Gov't	Native Gov't
ENVIRONMENT			
Fish Migrations	Adverse	Minimal	Minimal
Bird Habitat	No Impact	Minimal	Minimal
SUBPORT DEVELOP.			
Proximity to Port	Adjacent	12 Miles	2 Miles
Near Kobuk River	No	Yes	Yes

* See Appendix C

and this causes problems of access and security. The existing site has several advantages. It is convenient, has sufficient water depths to accommodate river barges, is established, has an adequate site to accommodate present and anticipated demands for village cargo handling, has supporting facilities in place, and is secure. The probability that most users of an alternative site would also travel to Kotzebue weighs in favor of continued use of the existing facility as a subport. The site identified for development in conjunction with Cape Blossom port might be appropriate for some sort of transportation related development in the future and could therefore be considered for acquisition by the City.

It is the recommendation of this siting analysis that the City dock should be retained as a subport.

AIRPORT SITING ANALYSIS

8.0 PRESENT AIRPORT OPERATIONS

The Ralph Wien Memorial Airport is covered by the Nome Sectional Aeronautical Chart. It is classified as an air carrier type of airport, and provides that level of service. The airport is owned and maintained by the State of Alaska Department of Transportation and Public Facilities, and no landing fees are charged. Ralph Wien Memorial is located about one mile south of Kotzebue at airport reference point 66°, 53', 02"N latitude, and 162°, 36', 05"W longitude, at an elevation of 11.5 feet above mean sea level. The airport is situated on an approximately three-square-mile parcel, including Isaac Lake, which is used as a float plane basin. Facilities include a paved runway, gravel surfaced cross-wind runway, fuel storage facilities, minor air frame and power plant repair facilities, and three hangers. (Refer to the Airport Layout Plan, Figure B-8.1 and FAA Form 5010-1, Figure B-8.2). Federal Aviation Administration (FAA) records show approximately 58,000 operations occur at the airport in a one year period, consisting of 30,000 general aviation operations, 20,000 air taxi operations, 1,000 general aviation operations, and 1,000 military operations. FAA records show that 58 single engine and seven multiengine aircraft as well as one helicopter and two military aircraft are based at Kotzebue. Float plane traffic is also present. Large transport aircraft using the airport include Boeing 737's, Boeing 727's, and Lockheed Hercules. Terminal navigational aids include a very high frequency omni-range installation with distance measuring equipment, non-directional beacon, and a distance finder. Mean daily maximum temperature during the hottest month is reported to be 59°F. The combined 15 MPH cross wind coverage of both runways is 99%.

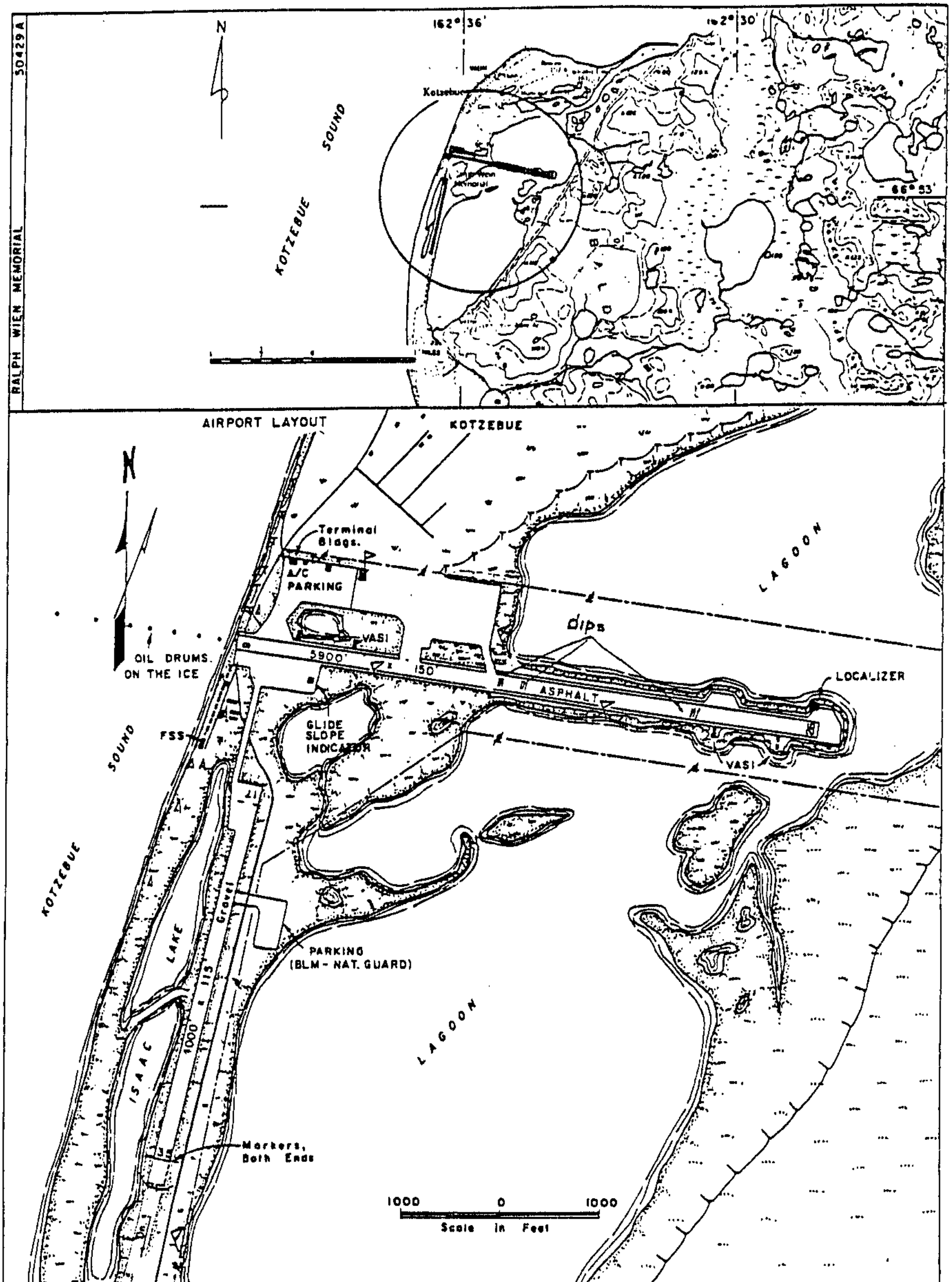


FIGURE B-8.I AIRPORT LAYOUT PLAN

US DEPARTMENT OF FEDERAL AVIATION — AIRPORT MASTER RECORD — ,011 APPROVED OMB No. 04-R0001

>1 ASSOC CITY: KOTZEBUE 4 STATE: AK FAA SITE NR: 5#425.A
>2 AIRPORT NAME: RALPH WIEN MEMORIAL 5 COUNTY: KOBUK AK
3 CBD TO AIRPORT(NM): #1 S 6 REG/ADO: AALINCNL 7 SECT AERO CHT: NONE

GENERAL

1# OWNERSHIP: PUBLIC
>11 OWNER: ST OF ALAS DOT
>12 ADDRESS: POUCH 6981
ANCHORAGE, AK 99582
>13 PHONE NR: 911-241-1111

15 ADDRESS: BOX 55
KOTZEBUE, K 99152
>1b PHONL NR: 9#7-442-3147
>17 ATTENDANCE SCHEDULE:.
MONMS DITS HOURS
ALL MON-FRI #8##-163#

18 AIRPORT USE: PUBLIC
19 ARPT LAT: 66-53-#6.4N SURVEYED
2# ARPT LOHG: 162-35-46.#V
21 ARPT-ELEV: ##811 SURVEYED
22 ACREAGE:
>23 RICH1 TRAFFIC:
>24 NON-COMM LANDING FEE: NO
25 NASP/FEDERAL AGREERENT: NGSY
26 FAR 139 INDEX: •AAS#5/73

SERVICES

>7# FUEL: 8# 1## A
>71 AIRFRAME RPRS: MINOR
>72 PUR PLANT RPRS: MINOR
>73 BOTTLE OXYGEN: NONE
>1b BULK OXYGEN: NONL
75 TSNT STORAGE: HGR
76 OTHER SERVICES: CARLO

BASED AIRCRAFT

98 SINGLE ENG: 5
91 MULTI ENS:
92 JET:
TOTAL /

93 HELICOPTERS:
94 GLIDERS:
95 MILITARY:

FACILITIES

>8# ARPT BCN: •CG
>81 APT LGT SKED: DUSK-DAWN
>82 UNICOM: 122.8##
>83 WIND INDICATOR: YES
84 SEGMENTED CIRCLE: YES
85 CONTROL TWR: YES
86 FSS: KOTZEBUE
87 FSS ON ARPT: TCS
88 FSS PHONE NR: 917-442-3311
69 TOLL FREE NR: 442-331#

OPERATIONS

1## AIR CARRIER:
1#1 COMMUTER:
1#2 ATR TAXI: 2###
1#3 G A LOCAL: 711
1#4 G A ITNRNT: 3111
1#5 MILITARY: 1##
TOTAL: 58##

OPERATIONS FOR 12 MOS ENDING #5AUG81

RUNWAY DATA

>31 RUNWAY IDENT	#8/26	17/35			
>31 LENGTH:	5911	4111			
>32 WIDTH:	151	115			
>33 SURF TYPE-CON0	• ASPH	GRAVEL			
>34 SURF TREATMENT					
15 GROSS WT: SW	111				
36 (IN THSDS) DY	128				
37 DTW	24#				
38 DDTW					

LIGHTING/APCH AIDS

	OBI26	17/35			
>4# EDGE INTENSITY	HISH	MED			
41 NOW ELEMENT-81	DUSK-23## —	DUSK-DAYC			
>42 RWY MARK TYPE-COND	PIR-P /PIR-P	NONE /NONE	▮	/	/
>43 VASI	V4L /V4L	N IN	▮	/	/
44 THR CROSSING HGT	/	/	/	/	/
45 VISUAL GUDE ANGLE	/3.5#	/	/	/	/
>46 CNTRLN-TDZ	N-L IN-N	N-N /N-N	/	/	/
>47 RVR-RVV	1-N /N-N	N-N IN-N	/	/	/
>48 REIL	Y IT	Y /N	/	/	/
>49 APCH LIGHTS	/	/	/	/	/

OBSTRUCTION DATA

	16/26	17/35			
5# FAR n CATEGORY	PIR /C-	B(V) /B(V)	/	/	/
>51 DISPLACED THR	/	/	/	/	/
>52 CTLG OBSTN	CLEIR /HILL	ROAD A/ROAD	/	/	/
>53 OBSTN MARKED/LGTD	/	/	/	/	/
>54 HGT-ABOVE RWY END	/		/	/	/
>55 DIST FROM RWY END	/75#	/15#	/	/	/
>56 CNTRLN OFFSET	/	/	/	/	/
57 OBSTN CLNC SLOPE	5#:1 /2#:1	#:1 /1#:1	/	/	/
58 CLOSE-IN OBSTN	•Y IN	N /N	/	/	/

2#:1 LANDING LENGTH

	#8/26	17/35			
## LANDING RWY-LENGTH	/	/	/	/	/
61 CTLG OBSTACLE	/	/	/	/	/
62 HGT-ABOVE THR	/	/	/	/	/
63 DIST FROM THR	/	/	/	/	/
64 CNTRLY OFFSET	/	/	/	/	/

(>) ARPT MGR PLEASE ADVISE FSS IN ITEM 86 WEN CHANGES OCCUR TO ITEMS PRECEDED BY >

>11# REMARKS:

A#17•• ALL/MON-FRI/#8##-163#,OTHER TIMES ON REQUEST.
A#26 CLSD TO CAB CERTIFICATED UNSKED AIR CARRIER UNLESS 24 HRS WRITTEN NOTICE TO ARPT MGR AND PRIOR APPROVAL RCVD; EXCEPT YON-SUED ALL CARGO OPERATIONS.
A#33 RWY 18 126 NUMEROUS CRACKS & DIPS THROUGHOUT THE LENGTH OF RUT.
A#58 RVT #8 ROAD 4## FM THR.
A#8# ROTG BCH LCTD 66-54-#7.5/162-33-47.8.
A#8# RWY 1 ADDITIONAL ARPT BCN LOCATCD ON TOP OF HANGER ADJACENT TO PARKING AREA; COLOR-GREEN AND GREEN.
A11# -44# RWY LGTS 8/26 & 17/35 EXTEND 31 INCHES ABOVE GND.
A11# -#1 UNCTLD VEHICULAR TFC CROSSING ADJACENT TO RWY 8.
1111 -#2 NO SNOY REMOVAL OR DEICING PERFORMED BTN HOURS OF 21##-#7##. RWY COND REPORTS WILL REFLECT COND DURING DAT OPRS ONLY #7##-21##.
1118 -#3 CAUTION: DO NOT MISTAKE ROT6 BEN 3 MILLS SOUTH OF ARPT IS THE ARPT ROTG BCN.
All1 - 41 RWY LGTS OPERATE DUSK-2388 OTHER HOURS CONTACT OTZ FSS.

111 INSPECTOR: (F) 112 LAST INSP: #5AUG81 113 LAST INFO REQ:

FAA Form 5010-1 (8-80) SUPERSEDES PREVIOUS EDITION

FIGURE B-8.2 FAA FORM 50101

The asphalt-paved runway (Runway Number 8/26) is 5900 feet long by 150 feet wide, and is constructed of asphalt underlain with Styrofoam insulation from the west threshhold to the lagoon. It has a Federal Aviation Administration single wheel gross load strength rating of 100,000 pounds, a dual wheel loading of 128,000 pounds, and a dual tandem wheel loading of 240,000 pounds. Runway navigational aids at the paved runway include a VASI at each end of the runway, high intensity edge lights, runway end identifier lights, and a localizer with distance measuring equipment. Future plans call for upgrading the airport to an instrument landing system facility with a medium intensity approach light system. The paved runway is categorized as a precision instrument runway, but the PIR markings are reportedly in poor condition. It is equipped with a medium intensity runway lighting system with future plans to upgrade to a high intensity runway lighting system, a glide slope facility, and taxiway lights. A hill causes a slight obstruction when approaching from the east. Runway 8 has an approach surface over water and Runway 26 has an approach surface of 20:1. Future plans call for upgrading the latter approach slope to 34:1. The runway safety area is 220 feet wide by 6,300 feet long, which is a deviation from design standards requiring a 500 foot wide runway safety area. The runway has numerous cracks and dips throughout its length. The runway has 93 percent 15 MPH crosswind coverage based on 10 years of weather records.

The gravel strip (Runway Number 17/35) is 150 feet wide by 4,320 feet long. The strip has end markers and fluorescent edge markers. A rotating beacon is installed at the site. Future plans call for upgrading the strip by installing a medium intensity lighting system. The strip is categorized as a non-precision runway and there are no immediate plans to upgrade its category to a precision landing facility. The runway safety area is 300 feet wide by 4,750 feet long.

Float planes are reported as landing adjacent to the gravel strip. The runway has 69 percent 15 mile per hour crosswind coverage.

9.0 AIRPORT SITING REQUIREMENTS

9.1 SITE AND ORIENTATION

The principal runway at the Kotzebue airport is sufficient to accommodate Boeing 737's and Lockhead Hercules. A runway of comparable length (5900 ft.) is considered as the minimum requirement at an alternate site. Ultimate airport size and use must be considered when locating an airport. The site should not be hemmed in by built-up property, mountains, rivers, harbors or other features that prohibit enlargement except at excessive cost. Although initial land acquisition should include all areas needed for ultimate development, there should be ample undeveloped land available adjacent to the site. This land should be protected against uncontrolled growth of industrial or residential property.

Runway orientation should provide for maximum wind coverage and clear approaches while situated on the topography to minimize fill and drainage costs. Prevailing east-west winds dictate an east-west orientation for the primary runway. Although a cross-wind runway may not be immediately required, it is reasonable to plan for a cross-wind runway which is at least 80% of the length of the primary runway. Approximately 2 square miles should be acquired to accommodate the landing, approach, and building areas.

Terrain should be relatively flat to avoid excessive fill requirements. Elevated sites are preferable to those in lowlands because they tend to have less obstruction in the approach zones, less fog, fewer erratic wind conditions, and better drainage.

Soils must be capable of supporting the runway and other structures. Although the soils in the project area are generally poorly drained and underlain by permafrost, insulated embankments can satisfy this criterion.

The airport should be compatible with local and area planning such that the airport and the surrounding area can be developed without interfering with each other. The airport location should be selected to minimize impact on native allotments and subsistence activities. Prior to final commitment to a site, approval by the Federal Aviation Administration is necessary to insure air space compatibility so that air traffic patterns don't interfere with each other.

9.2 UTILITIES AND ACCESS

Utility systems required at the airport would include water, sewer, fuel distribution, electricity and communication networks. It is unlikely that the existing utility system for Kotzebue can be extended to supply all needs at a remote airport site. On-site water and waste water treatment facilities will be required.

Overland access to the airport would be accomplished via a road from Kotzebue. The State of Alaska Department of Transportation and Public Facilities (DOT & PF) is presently studying access to the southern end of Baldwin Peninsula and has developed preliminary alignments which pass near the alternate airport sites.

10.0 ALTERNATE AIRPORT SITES

10.1 SITE SCREENING CRITERIA

This section describes the process by which potential airport sites on Baldwin Peninsula were screened to identify the general airport location alternatives. The exact location of the airport and related facilities will be determined in a later phase.

A general description and assessment of each site is presented and then followed by an evaluation of potential sites using the location evaluation criteria presented below. This information is then summarized and presented on a comparative basis. Identification of candidate port sites preceeded the identification of potential airport sites. In order to provide realistic interaction between the port and airport, a radial distance of 3 miles was selected as a maximum separation between the port and any part of the airport. Other potential airport sites will reportedly be analyzed as part of an upcoming Kotzebue airport master plan by Alaska DOT & PF.

The alternate airport sites associated with the deepwater port project are: 1) the existing facility, 2) a site near Cape Blossom and 3) a site about midway along the narrow isthmus of the Baldwin Peninsula, called the Isthmus site. Alternate sites are shown on Figure B-6.1.

Evaluation Criteria. Existing master plans and studies, zoning ordinances, base and aerial maps, surveys, topographic and oceanographic data, geological information (both published and gathered during a site inspection), and land ownership information were considered in the site selection process.

Several preliminary evaluation criteria were established to provide an analytical framework for comparing site alternatives. These criteria represent the basic evaluation factors to be considered when evaluating a number of potential sites. They include accessibility, land-use, engineering (with cost being an implicit element of engineering), socioeconomics, and environmental impact. These criteria are listed below, along with a brief description of the measurement for each one.

Accessibility. Airport accessibility considerations include both airside and landside site access. For airside access, evaluation considerations included wind and weather factors and the probable magnitude of required access improvements, such as removal of obstructions. For landside access, an assessment included the nature and magnitude of existing land based transportation facilities and services that would support each location alternative, including the distance between the site and Kotzebue.

Land Use. Land use considerations included the existing ownership of land required for the facility as well as the compatibility of land use with respect to existing and proposed adjacent land uses. The land ownership criterion involved a qualitative assessment of the degree of difficulty associated with acquiring the land necessary for airport development. Specific considerations included legal and administrative factors, such as public/private ownership and land use restrictions. The land use compatibility criterion involved a qualitative assessment of the consistency of an airport land use with other existing and planned uses adjacent to each location alternative. This assessment included a review of each location's consistency with the adopted land use plan for Baldwin Peninsula and other published policy statements and public programs regarding port and community development.

Engineering. Total site capacity and airport related implementation time were the factors considered under this category. Site capacity was defined as the amount and configuration of available land for airport facility development. Certain sites may be constrained in terms of usable land area by adjacent land forms and development, while others may have ample developable area to accommodate the entire facility.

Constructibility was assessed by examining the implementation time-frame associated with each site and the amount and degree of difficulty of required supplemental or associated construction.

Site flexibility and expandibility represented the capability of each candidate site to be developed beyond its initial design. The size and configuration of each site affected its flexibility to accommodate additional and different types of terminal related functions, such as additional storage and circulation space and expanded operations facilities.

Socio-Economic. The term "socio-economic" was interpreted very broadly in this evaluation process, it classified criteria related to business impacts and the security and safety aspects associated with airport development.

Business impacts were assessed by examining the amount and probability of disruption of adjacent existing businesses caused by the construction and operation of an airport. Certain businesses and subsistence activities may suffer temporary or permanent disruption due to airport development at a given site.

The security and safety aspects examined included the location of the site with respect to community police services and the degree of difficulty in securing and protecting the site. Remote sites are more difficult and expensive to secure, compared to sites located near existing or planned activity areas of a similar nature. Other sites may exhibit inherent safety problems due to the presence of hazardous materials, heavy industrial activities, or physical obstructions or hazards.

Environmental Impact. A qualitative assessment of the environmental impact of alternate sites was made. Sites which required greater alterations of the terrain or which impacted a particularly sensitive ecosystem received a lower rating.

10.2 ALTERNATIVE SITE DESCRIPTIONS

The site evaluation criteria were applied to each of the three sites described below. The comparisons are based upon field reconnaissance, discussions with City, FAA, DOT/PF staff, and analyses of available population, economic, environmental, travel, and design data.

Existing Site

The existing site is very convenient to downtown users but is located in a congested area with limited opportunity for expansion (see Figure B-6.2). Additionally, there are flight obstructions when approaching from the east. The airport land use is certain to become increasingly incompatible with adjacent land uses as Kotzebue continues to grow: the airport now causes some disruption in terms of vehicles, traffic, noise and congestion, and airport lease lots are a source of continuing controversy. The present airport has used almost all available space for expansion, and storage space is limited. The existing site effectively blocks development of Kotzebue toward the south. A study is underway to evaluate the feasibility of extending the runway 1000 feet west into Kotzebue Sound. Expansion of the existing facility probably can be accomplished more quickly than a new site can be constructed. Residents, visitors and numerous aviation related and non aviation related businesses appear to benefit from the airport in its present location.

Cape Blossom Site

Approaches to the Cape Blossom alternative airport site are unobstructed, with access from the west over Kotzebue Sound, and access from the east over relatively flat terrain (see Figure B-6.3). The hills of Cape Blossom can be readily avoided by a potential cross-wind runway. The slightly elevated site may experience less ground fog than occurs at the current airport. The site is not connected to Kotzebue by road. DOT & PF is presently studying the feasibility of constructing a road from Kotzebue to Chicago Creek by way of Cape Blossom. Access to Cape Blossom during the winter for passenger traffic would be a formidable problem, with safety of travelers being a significant concern. Summer travel to the Cape would be much easier. Land surrounding the alternative site has been native selected. The land is undeveloped, and no development plans have been identified. Acquisition of land for the airport from the native corporations should not be overly difficult given its undeveloped status. Location of the airport within a couple of miles of the port should provide opportunities for multiple use, particularly for industrial users. A site of adequate size could probably be acquired for the airport, including space to accommodate possible future expansion (see Figure B-6.4). Assuming sufficient construction materials, particularly gravel, can be found, airport construction time should not be excessive. Without the access road from Kotzebue, however, construction would be considerably more difficult and would probably take longer. An airport at Cape Blossom, near a new deepwater port, would provide significant opportunities for economic growth and development. A runway with minimal appurtenances, designed to serve industrial users, appears to have advantages. This concept was also suggested at the public hearing. A number of business and residences may be attracted to the area. Airport development at Cape Blossom may disrupt some subsistence use of the area. The environmental effects of airport construction at Cape Blossom are those to be expected from any major construction effort in the Arctic. No endangered species appear likely to be affected by airport construction.

Isthmus Site

The identified isthmus site also has clear airside approaches from all directions (see Figure B-6.5) but not as much so as the Cape Blossom site. Landside access is considered poor, however, with a 25 mile distance separating the potential airport from Kotzebue. The land in this area has been native selected and top filed by the State of Alaska. The land has been tentatively designated for transportation-related uses. The land is now undeveloped, with the major use being subsistence and wintertime overland access to the mainland. Adequate land is available for initial construction and possible future expansion at the Isthmus Site (see Figure 8-6.6). The primary runway must be oriented east-west, which would tend to create a barrier across this narrow strip of land. Assuming the Kotzebue to Chicago Creek road is constructed at least as far as the Isthmus site, construction time should not be unusually protected. Construction of a port/airport/subport at this site has the potential to stimulate growth of a subcommunity at the Isthmus. While disruption of existing activities is a relatively minor problem, providing security at this distant site would be difficult. Environmental impacts would approximate those of construction at other sites on Baldwin Peninsula. No unusual environmental. effects have been identified.

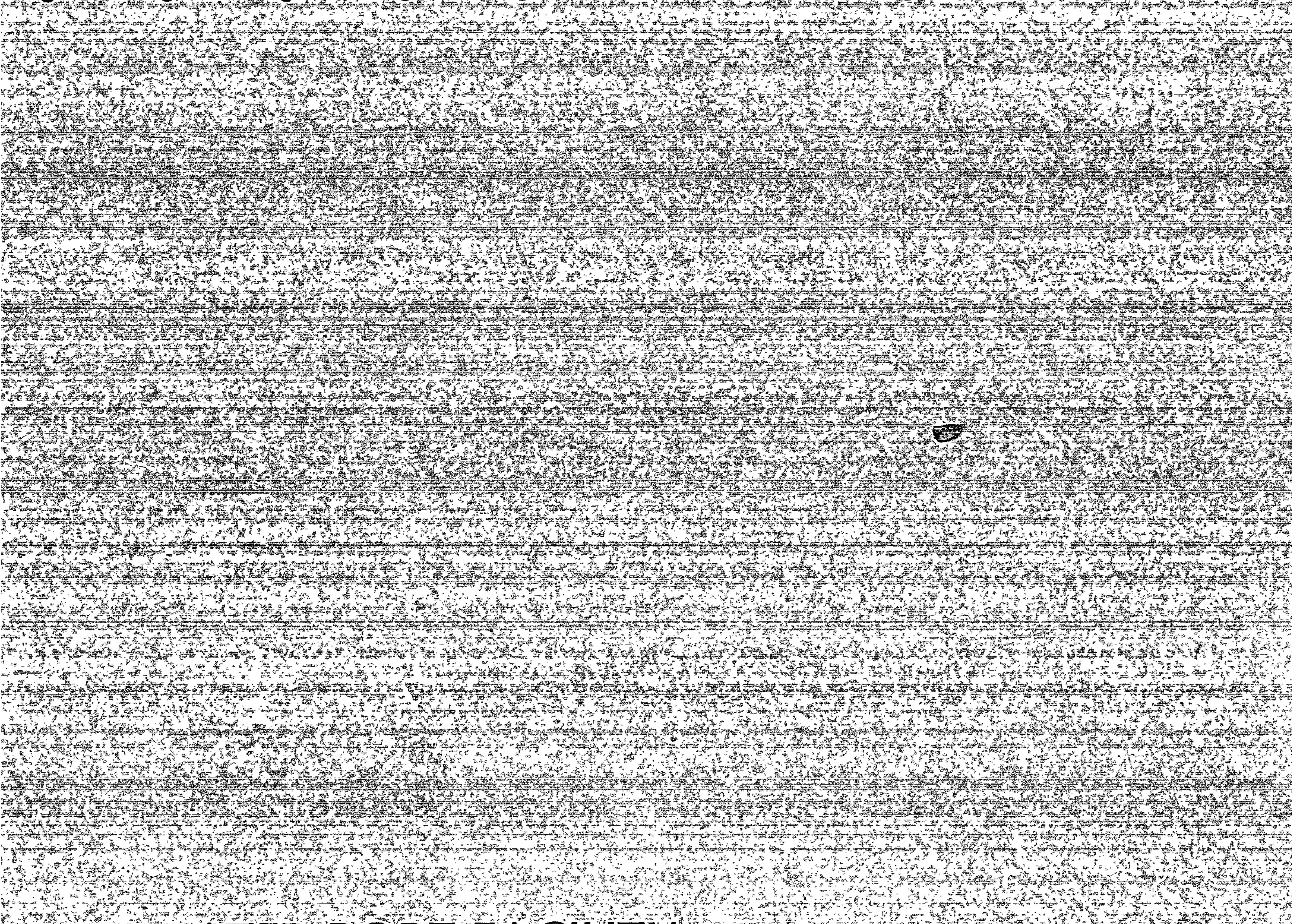
10.3 AIRPORT SITE COMPARISON AND CONCLUSION

The city airport is located within Kotzebue. Cape Blossom is 12 miles from Kotzebue, and the Isthmus site is 24 miles distant. The distance to the Cape Blossom and Isthmus sites would create a major problem for residents and visitors using the airport. Especially during the winter months, transportation to the airport would be a safety hazard. At the public meeting, several comments were made in opposition to relocating passenger operations to such remote sites.

Access from the air is probably best at Cape Blossom. The existing airport and the Isthmus site share a common problem with approaches, with hills on one end of the runway causing slight obstructions.

The land ownership situation is similar at the Cape Blossom and the Isthmus site, whereas land has already been set aside for the airport at Kotzebue. Land use compatibility at Kotzebue is poor, however, compared to the undeveloped alternate sites.

Site expansion capacity is a major factor limiting the city airport, since most expansions must be located on valuable property. The Isthmus site also has limited expansion opportunities, but opportunities for expansion near Cape Blossom are essentially unlimited. Economic development opportunities would probably be enhanced by the establishment of an airport at either of the distant sites, as businesses would probably develop to support the facility. While the present airport disrupts the city somewhat, relocation of the passenger operations to either alternative site would have very major disadvantages both in terms of convenience and safety.



DEEPWATER PORT FACILITY

DEEPWATER PORT FACILITY

1.0 PORT PLAN FORMULATION

The siting analysis concluded that a deep-water port at Cape Blossom is the best solution to reduce or eliminate lightering and to serve projected shipping increases at Kotzebue including coal exports. The siting analysis also recommended continued transshipment to upriver villages from the existing dock at Kotzebue, continued passenger service from the existing Kotzebue airport, and provision for a future cargo-only airstrip adjacent to the deep-water port at Cape Blossom.

The siting analysis projected total costs to be in excess of $100 million for port development at Cape Blossom. Because of this substantial cost, it is desirable to explore alternatives to deepwater port development and to conduct a trade-off analysis. This was accomplished by developing a scenario for expansion of existing port facilities at Kotzebue and comparing this to the Cape Blossom plan, as discussed in the next section.

1.1 EXPAND EXISTING FACILITY

Some space for on-shore port expansion could be ootained by relocating the existing Chevron tank farm to a location outside of town. The vacated area could then be used for increased warehousing, breakbulk, and transshipping storage. It is desirable to relocate the fuel storage area in any event. The existing tank farm represents a serious safety hazard because of its proximity to residential areas, its extremely compact spacing, and its lack of berming to contain fuels from leakage, spillage, or tank rupture.

Expanded on-shore facilities would allow more flexibility in cargo handling and scheauling. Throughput ana transshipment operations could be streamlined, and scheduling improved, with more space available for operations. Some monetary savings from improved and streamlined operations could be passed on to port users.

Utilities could be provided at a lower initial cost in Kotzebue than at Cape Blossom.

1.2 EXPANSION VS. KELOCATION

Prior studies ay the Corps of Engineers and others have indicated that it is not feasible to dredge and maintain access channels and a dock of sufficient depth to receive ocean-going vessels at the existing port.

The consequent need for lightering of all cargo, which raises shipping costs and increases shipping delays, would not be solved by expanded facilities. These costs and delays would continue until a deep-water port is developed.

Expansion into the vacated tankfarm area would not eliminate all land use conflicts. There is a need for additional commercial, industrial and multiple residential development land in Kotzebue, and the vacated land may be sought for those purposes as well as for port expansion.

Expansion of on-shore facilities at the existing port and streamlining of present operations provides a feasible but limited alternative to development of a new deep-water port. Expansion would improve present operations and allow more efficiency in handling existing levels of shipping. It would not, however, be of significant value in handling large increases in shipping that would result from increased mining operations at Chicago Creek or increased oil exploration in the Chukchi Sea. In short, expansion would improve existing shipping efficiency (although lightering would still be necessary), but it would not increase shipping capacity to receive larger vessels. At best, expansion would delay the need for a deepwater port but would not eliminate the need. Inherent benefits and limitations of expansion of the present facility are:

Benefits:

- lower costs.
- existing land use patterns would continue.
- existing infrastructure could be used and expanded at relatively low cost.

Limitations:

- It is not feasible to deepen the berth or to maintain a dredged channel;
- Lightering operations would still be needed: consequently, shipping costs and time delays would still be substantial.

- expansion space is limited.
- existing land use conflicts would continue and intensify.

It seems apparent that a deep-water port to directly accommodate ocean-going vessels must eventually be built if Kotzebue is to retain its role as "Gateway to the Northwest Arctic."

1.3 FINAL SITE SELECTION

The goal of improving current shipping at Kotzebue and providing for increased shipping can best be met by constructing a new deep-water port outside of existing city limits. Based on the investigations and conclusions of Part B (Siting Analysis), Cape Blossom appears to be the Dest site for development of a deep-water port.

Development of preliminary designs for the Cape Blossom port, together with on-shore support facilities and an adjacent cargo airport, is presented in the following report section.

2.0 PRELIMINARY ENGINEERING - OFFSHORE

2.1 CONCEPTUAL OFFSHORE PLAN

Because of the physical size of the structures required for deepwater port operations and the magnitude of ice and wave forces acting on them, extensive construction efforts will be required for the berthing facilities and causeway. For that reason, numerous alternative structures/systems were investigated from an engineering feasibility standpoint to determine the most cost-effective type of construction as compared to the basic rubble mound breakwater alternative.

The initial design objective for the port facility called for berthing depth of 30 feet below mean-lower-low-water for safe moorage and favoraole operating of a design vessel with a draft of 22 feet. The extra draft would allow for safety clearance, waves, and drawdown caused by unfavorable winds. Thirty feet of water depth is available 6,000 feet offshore of the Cape Blossom site, which is by far the most favorable location in the vicinity of Kotzebue.

During the siting analysis phase, an initial cost estimate was prepared for a berthing facility and connecting causeway at this location. After reviewing the cost estimate and projected port requirements, modifications to the configuration and a two-phase approach were conceived to provide flexibility in port implementation action.

Phase I (see Figure C-2.1) would accommodate present port requirements for berthing of ocean-going vessels and would eliminate the need to lighter cargo onto shallow draft barges. Phase I would include a 190' x 600' solid fill L-head pier and an 1,800 foot access causeway. A protected moorage with 18-feet of water depth for up to a 100' X 400' barge would be provided inside a oreakwater with an additional moorage outside the breakwater. The surface elevation of these piers would provide a 15 foot freeboard. It appears that 18 feet of water depth is adequate for vessels now calling at Kotzebue. By the time they reach Kotzebue, deeper draft barges have unloaded cargo at other ports, so they would be able to moor at the Phase I pier.

The desired 18 feet of water depth required for this phase exists approximately 1,800 feet from shore, resulting in a much shorter causeway than that required to reach the 30 foot water depth. An earthfill causeway with one structural span near shore would connect the pier with the shore. The elevated span would provide unobstructed open water for migrating fish.

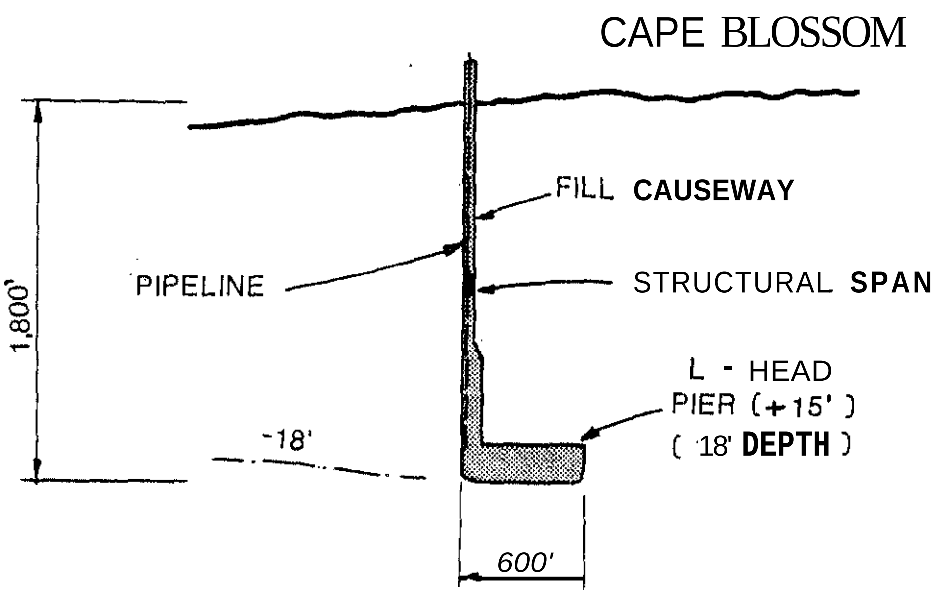
Phase II (see Figure **C-2.2**) would add another L-head pier **2,200** feet further offshore; the fill causeway would be extended to the outer pier. The outer pier would provide protected dockiny for offloading liquid fuels via pipelines traversing the causeway: this would reduce the draft of the vessel being off-loaded. The vessel could then move to the inner dock for offloading solid cargo, if desired. Bulk carriers would be loaded from on-shore stockpiles via conveyor.

To reduce causeway construction costs, the outer pier would be located at **25** feet of draft rather than 30 feet. The berthing facility and access lanes would be dredged to 30 foot depths. This approach would allow locating the outer pier 4,000 feet offshore, or **2,200** feet from the inner pier. Without dredging, it would need to be located **2,000** feet further offshore. Navigation aids would be provided to ensure safe and rapid docking of vessels.

PHASE I

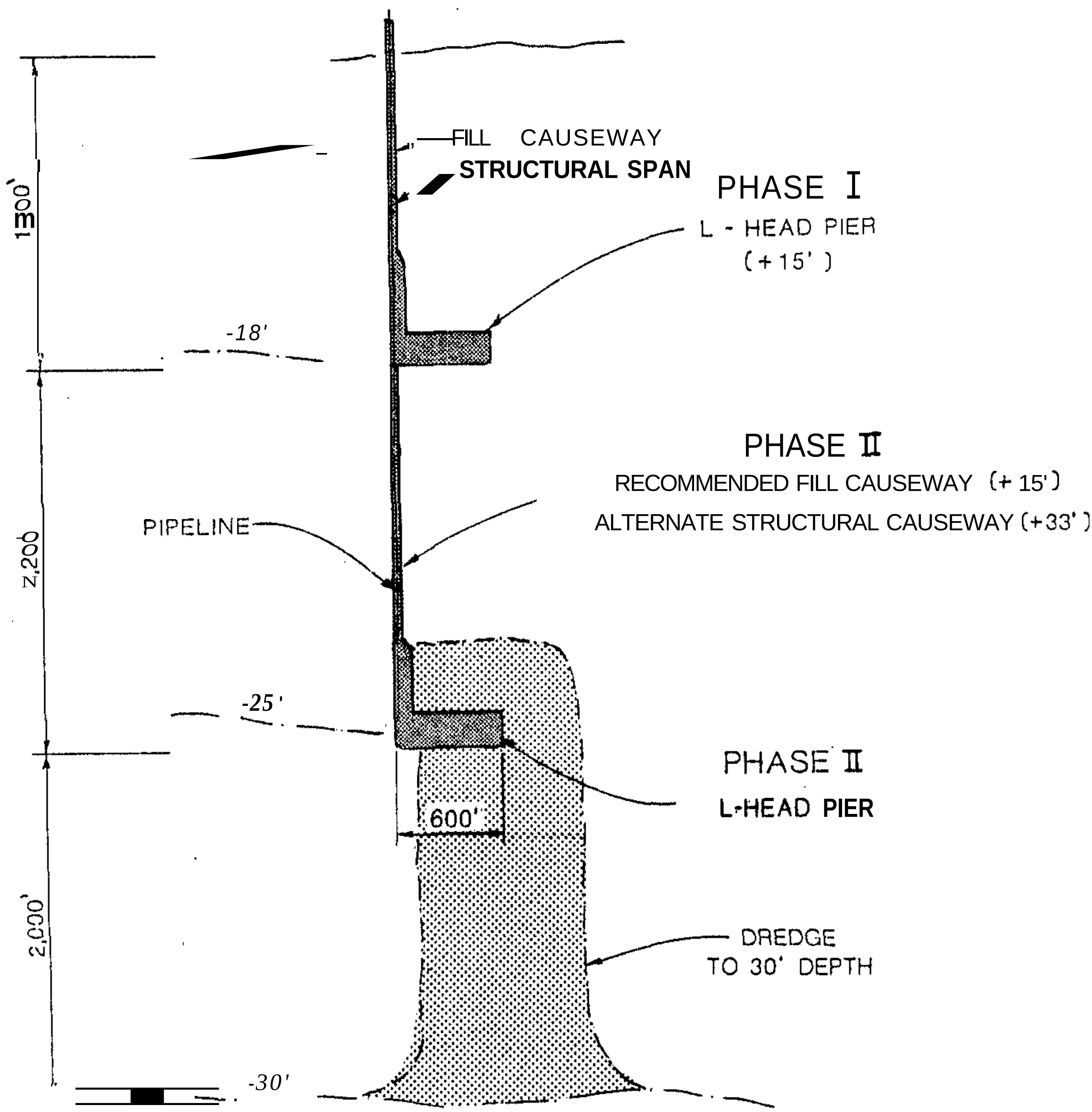
DEEPWATER PORT-CONSTRUCTION SCHEME

FIGURE c-2.1



PHASE II
DEEPWATER PORT CONSTRUCTION SCHEME

FIGURE
C-2.2



In the event that a solid causeway, even with intermittent spans, is not environmentally acceptable, a system of pier-supported, bridge-type construction has also been analyzed. Another factor working against the solid fill causeway is that suitable armor rock within a reasonable distance is apparently available only at Cape Nome and may not be available to this project.

The roadway surface of the solid fill causeway was established at a minimum width of 60'-0" providing two 12'-0" traffic lanes and adequate width for utilities and wave protection. The fill causeway was designed to resist both wave and ice forces.

To minimize the amount of dredged fill required, the roadway surface was set at 15' above mean-lower-low-water to match the working surface of the pier. A wave deilector, either fabricated or of rock, would be installed on the seaward side of the causeway to prevent wave overtopping from combined maximums of tide, storm surge, and breaking waves.

The maximum wave height was based on a two foot tidal variation, six foot storm surge, and allowance for wave runup. The causeway was designed with 1:1.5 side slopes to prevent ice floes from over-riding the roadway. The walls would be protected with rock and armor stone blocks to guard against storm wave damage and to allow waves to break rather than running up the walls.

For the structural causeway option, a 24'-0" wide roadway consisting of two standard 12'-0" traffic lanes would be provided. An additional 3'-0" would be allowed for utilities, uncluding fuel transport, electricity, and communications. Space for Phase 1:I expansion was also considered. Since pedestrian traffic is not expected, sidewalks were not included.

Alternative pier and causeway structures were analyzed from both a functional aspect and a structural strength aspect. The alternative structures were required to have adequate size, height, position, and orientation for the proper transfer of cargo, and to have sufficient strength for resistance of expected ice and wave forces.

The elevation of the underside of the causeway piers was established at 22 feet above mean-higher-high-water, a height sufficient to provide clearance above waves. Without this clearance, the causeway would need to be designed witn extremely large cross sections and costly pier supports in order to resist the large forces generated by beaking waves.

Other, more detailed design criteria are presented in Appendix D.

2.2 PRELIMINAKY DESIGN SCREENING

This section describes potential structural alternatives to the earthfill causeway and alternative schemes for berthing facilities. The methods and results of comparison are also described.

The types of structures considered, are: (1) the causeway superstructure; (2) the causeway support structure; and (3) the berthing facilities. For each type of structure, various schemes were identified and developed. The Phase I and the Phase II piers both use the same structural berthing schemes.

The structural schemes were designed according to previously described criteria (see Section 2.1 and Appendix D), in sufficient detail to allow critical evaluation and comparisons. For each scheme, sizes of structural components, types and quantities of construction materials required, relative construction costs, and general construction requirements were determined.

Each scheme was then compared according to such factors as cost, structural performance, and constructability. The evaluation was performed by rating each scheme according to weighted factors in a screening matrix. Relevant factors identified for each type of structure were assigned a weight between 1 and 10 according to relative importance. Each scheme was then rated on a scale of 1 to 10 (low to high) for each factor.

The overall rating for each scheme was obtained by summing the products of the rating for each factor and that factor's weight.

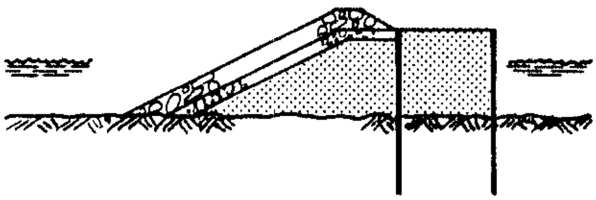
The highest ranking scheme for each type of structure was chosen for more detailed design and cost estimation. These "selected schemes" are described later in this section.

The alternative berthing facility schemes are described in Table C-2.1 and Figure C-2.3. A comparative summary is presented in Table C-2.2. Likewise, alternative causeway superstructure schemes are described in Table C-2.3 and Figure C-2.4; they are compared in Table C-2.4. Finally, alternative causeway support schemes are described in Table C-2.5 and Figure C-2.5 and compared in Table C-2.6.

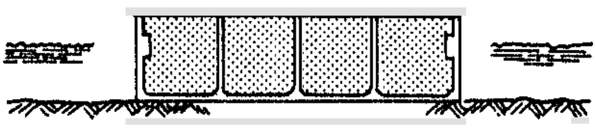
BERTHING FACILITIES SCHEME DESCRIPTION TABLE C-2.1

Scheme	Description	Comments
1	Cellular Sheet Piling Steel sheet piling cells are driven to the required embedment in the sea floor. The cells are filled with dredged material.	Rated Lower in screening matrix. Requires extensive pile driving.
2	Concrete Caisson A precast concrete cellular caisson is towed into place and grounded by filling the cells with dredged material	Rated lower in screening matrix.
3	Steel Caisson Similar to scheme 2 except a built-up steel caisson is used.	Rated lowest. High cost, steel potential corrosion problems.
4	Steel Retaining Wall Structural steel frames support steel sheet piling to form a counterfort retaining wall. Steel piles are driven into the sea bottom to position the wall and provide structural support. Fill material is placed behind the wall to form the working surface.	Rated low in screening matrix. High site time, corrosion problems
5	Concrete Retaining Wall Similar to scheme 4 except precast concrete caisons are used.	Selected scheme. LOW cost.

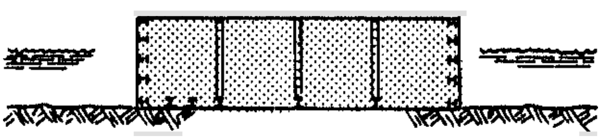
BERTHING FACILITIES SCHEMES FIGURE C-2.3



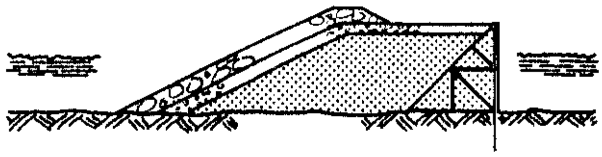
1. CELLULAR SHEET PILING



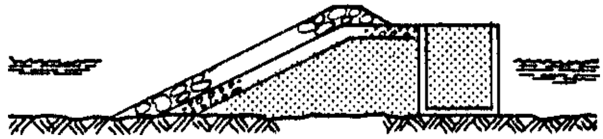
2. CONCRETE CAISSON



3. STEEL CAISSON



4. STEEL RETAINING WALL



5. CONCRETE RETAINING WALL

BERTHING FACILITIES SCREENING MATRIX

TABLE C-2.2

SCHEME		RATING/PRODUCT: SHOP COST	SHOP TIME	TRANSPORTATION COST	TRANSPORTATION TIME	FIELD COST	FIELD TIME	STRUCTURAL PERFORMANCE SHORT TERM	STRUCTURAL PERFORMANCE LONG TERM	TOTAL COST	WEIGHTED RATING	RANK
WEIGHT		4	2	4	4	5	8	8	10	9		
L-HEAD PIER	1A	9/36	9/18	8/32	7/28	4/20	4/32	5/40	5/50	6/54	310	2
	2A	4/16	4/8	2/8	2/8	8/40	8/64	7/56	7/70	4/36	306	3
	3A	2/8	4/8	2/8	2/8	8/40	8/64	5/40	5/50	3/27	253	5
	4A	4/16	5/10	5/20	5/20	4/20	3/24	5/40	5/50	9/81	281	4
	5A	5/20	5/10	5/20	5/20	7/35	6/48	7/56	7/70	7/63	342	1

CAUSEWAY SUI RE SCHEME DESCRIPTION
(Structural Causeway Alternative)

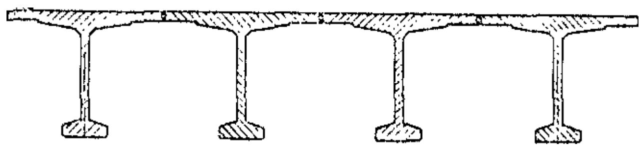
TABLE C-2.3

Scheme	Description	Comments
1	Precast Prestressed Decked Bulb Tee The causeway is formed by erecting four precast girders between the support structure abutments. The 6'to7' wide top flanges provide the deck surface. Individual girders are joined together with post-tensioned diaphrams at span third points. Grout is placed in the keys between girders.	Selected Scheme. Manufactured under controlled conditions. Minimizes field construction.
2	Prestressed/Post-Tensioned Girders Four precast prestressed standard highway girders are erected between piers. A concrete slab is cast in place compositely with the girders. Girders are joined together with CIP post-tensioned diaplirams at span ends and at span third points.	Rated lower in the screening matrix than Scheme 1. Requires cast in place slab.
3	Precast Concrete Box Girders Two cell concrete box sirder units are precast and transported to the site. The erection sequence would be determined by equipment available.	Eliminated because of erection difficulties.
4	Steel Box Girder Prefabricated steel units are transported to the site. The erection sequence would be determined by equipment available. A wearing surface is required on the steel deck plate.	Rated low in the screening matrix
5	Composite Steel Girders Prefabricated steel plate girders are erected between piers. Steel cross frames are placed at span ends and at 25'-0" intervals. A concrete slab is cast in place compositely w/ the girders	Rated low in the screening matrix.

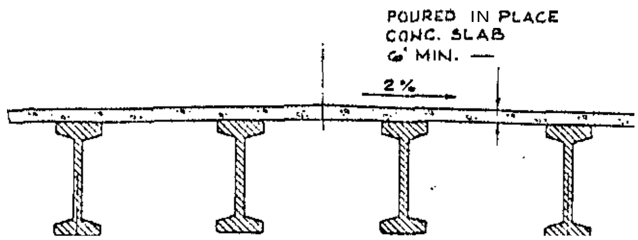
CAUSEWAY SUPERSTRUCTURE SCHEMES

FIGURE C-2.4

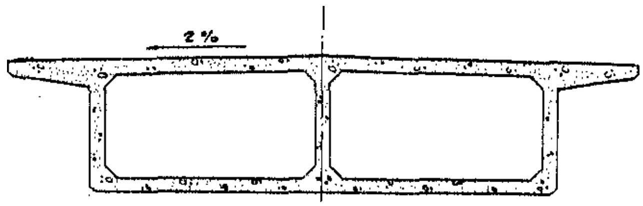
(STRUCTURAL CAUSEWAY ALTERNATIVE 3



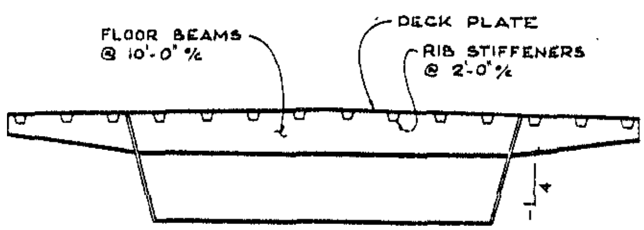
1 PRECAST PRESTRESSED DECKED BULB TEES



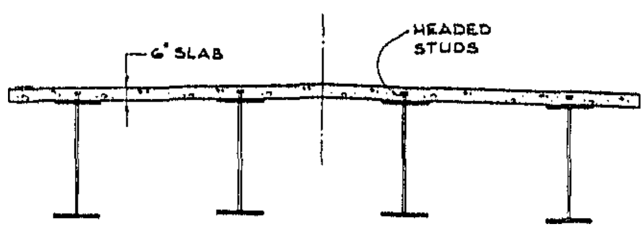
2 PRESTRESSED/POST-TENSIONED GIRDERS



3 PRECAST CONCRETE BOX GIRDER



4 STEEL BOX GIRDER



5 COMPOSITE STEEL GIRDERS

CAUSEWAY SUPERSTRUCTURE SCREENING MATRIX (STRUCTURAL CAUSEWAY ALTERNATIVE)

TABLE C-2.4

	RATING/PRODUCT											
SCHEME \ WEIGHT	SHOP COST	SHOP TIME	TRANSPORTATION COST	TRANSPORTATION TIME	FIELD COST	FIELD TIME	STRUCT. PERFORMANCE SHORT TERM	STRUCT. PERFORMANCE LONG TERM	MAINTENANCE	TOTAL COST	WEIGHTED RATING	RANK
WEIGHT	4	2	4	4	5	8	8	10	4	9		
1	6 / 24	6 / 12	6 / 24	6 / 24	8 / 40	9 / 72	8 / 64	8 / 80	7 / 28	8 / 72	440	1
2	7 / 28	7 / 14	7 / 28	7 / 28	6 / 30	7 / 56	6 / 48	7 / 70	7 / 28	7 / 63	393	2
3	4 / 16	4 / 8	2 / 8	2 / 8	3 / 15	2 / 16	5 / 40	9 / 90	8 / 32	6 / 54	287	5
4	4 / 16	3 / 6	3 / 12	3 / 12	5 / 25	6 / 48	7 / 56	6 / 60	4 / 16	5 / 45	296	4
5	7 / 28	8 / 16	8 / 32	8 / 32	6 / 30	7 / 56	5 / 40	5 / 50	2 / 8	4 / 36	328	3

CAUSEWAY SUPPORT STRUCTURES SCHEME RIPT
(STRUCTURAL CAUSEWAY ALTERNATIVE)

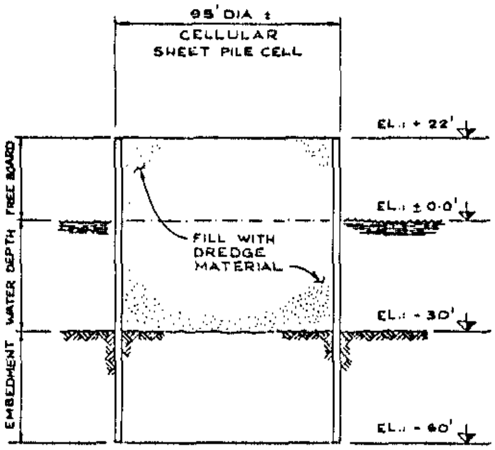
TABLE C-2.5

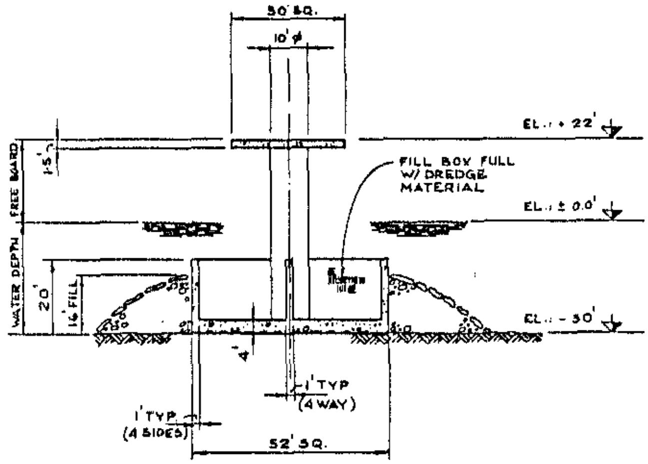
Scheme	Description	Comments
1	Cellular Sheet Piling A circular steel sheet pile cell is driven in place to the required embedment. The cell is filled with dredged material to the required elevation.	Rated Lower in screening matrix.
2	Concrete box-Base Monopod A rock/gravel base is constructed to provide a bearing for the structure. A cellular concrete box is floated into place and grounded with dredged material. The concrete box supports a central concrete pier with the causeway superstructure supports.	Selected scheme.
3	Steel Box-Base Monopod Similar to Scheme 2 except using a braced steel box & a built-up steel central column.	Rated lower than Scheme 2. Was ranked #2.
4	Steel Monopod (Interior Fill) A gravel base is constructed to provide bearing for the structure. A built-up steel cylinder with a widening steel base is floated into place & grounded with dredged fill. The monopod structure is filled with the dredged material to provide the working surface. Side fill covered by slope protection is placed around the base.	Rated lower in screening matrix
5	Concrete Monopod (Interior Fill) Similar to Scheme 4 except using a lightweight concrete cylinder with a concrete base.	Rated lower in screening matrix.
6	Steel Caisson A hexagonal built-up steel caisson with concrete ballast is towed into position & filled with dredged material. Approximately 10 feet of fill is placed around the base.	Rated Lower in matrix.

Scheme	Description	Comments
7	Concrete Caisson Similar to scheme 6, except using a hexagonal concrete caisson with concrete bottom.	Ranked as #3 in screening matrix.
8	Floatable Steel Piles - Steel Base Alternative A: A square built-up steel box with perimeter box type ring beams & concrete ballast is floated into place. The steel box supports 4 unbraced concrete filled steel pipe piles & a smaller concrete causeway support slab structure. The steel box is filled with dredged material and surrounded with fill.	Rated low in screening matrix. Eliminated because of possible ice-bridging between piles.
9	Floatable Steel Piles - Steel Base Alternative 8: Similar to Scheme 8 except lateral bracing is added between pipe piles except at water line.	Rated low in screening matrix. Eliminated because of possible ice g. bridging on bracin
10	Floatable Steel Piles - Concrete Base Similar to scheme 8, except utilizes concrete box to support piles.	Rated low in screening matrix. Eliminated because of possible ice bridging.
11	Jacket Type Structure A square steel pipe pile structure with lateral bracing between vertical piles except at water line is placed on the sea floor. Smaller steel pipe piles are placed in the vertical piles and driven to the required penetration in the sea floor.	Rated lowest of all schemes in screening matrix. Eliminated because of possible ice bridging on bracing.
12	Gravel Island Causeway spans are supported by a fill island constructed using dredged material or mine tailings.	Rated low in screening matrix. Final cross-section required approaches that for a full earth filled causeway.

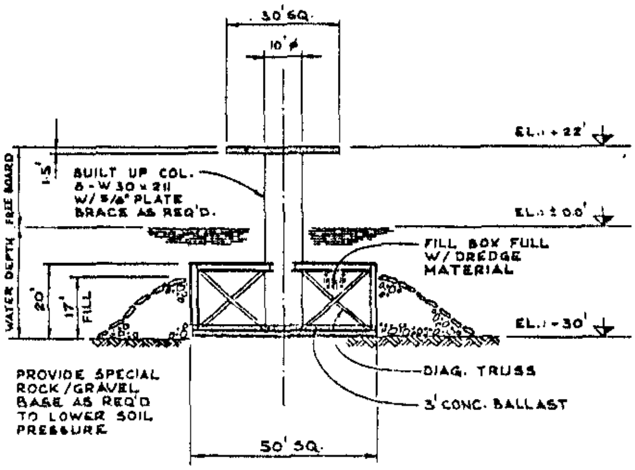
CAUSEWAY
SUPPORT STRUCTURE SCHEMES, FIGURE C-2.5

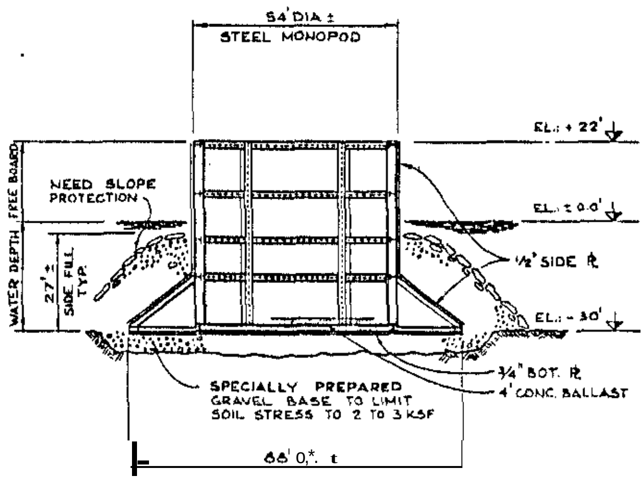
(STRUCTURAL **CAUSEWAY** ALTERNATIVE)





1 CELLULAR SHEET PILING 2 CONCRETE BOX-BASED MONOPOD



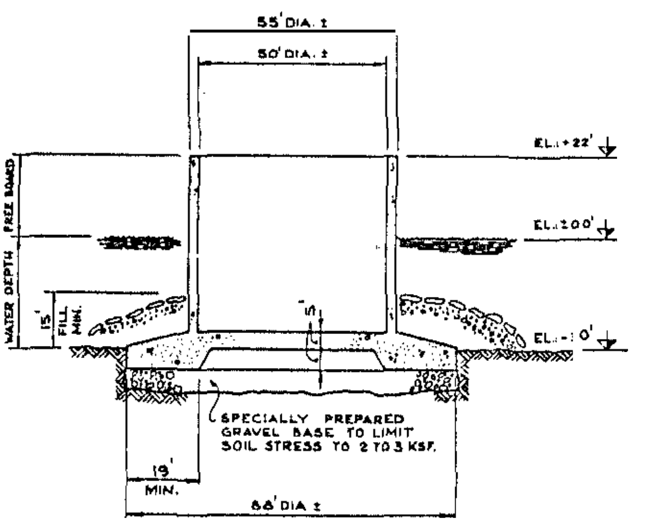


3 STEEL BOX-BASE MONOPOD 4 STEEL MONOPOD (INTERIOR FILL)

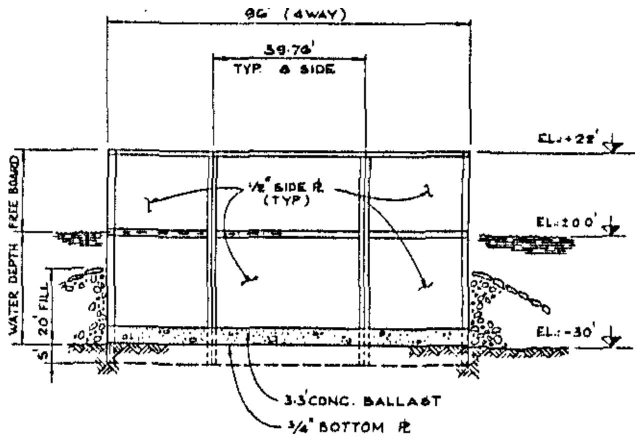
CAUSEWAY

SUPPORT STRUCTURE SCHEMES (cont.) FIGURE C-2.5

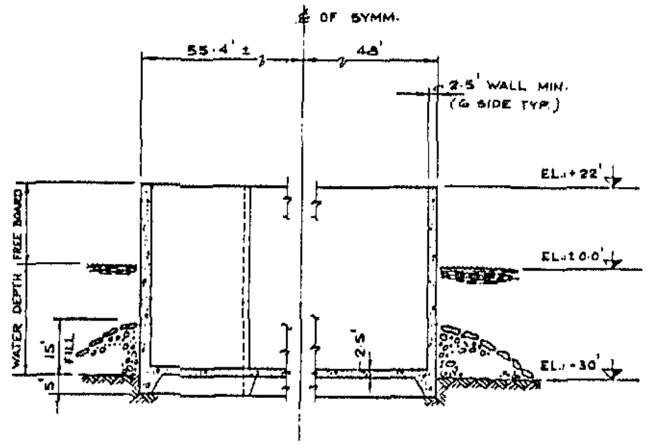
(STRUCTURAL CAUSEWAY ALTERNATNE)



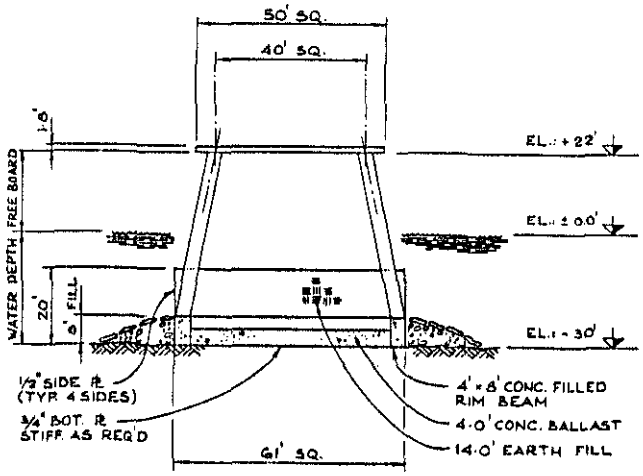
5 CONCRETE MONOPOD (INTERIOR FILL)



6 STEEL CAISSON



7 CONCRETE CAISSON

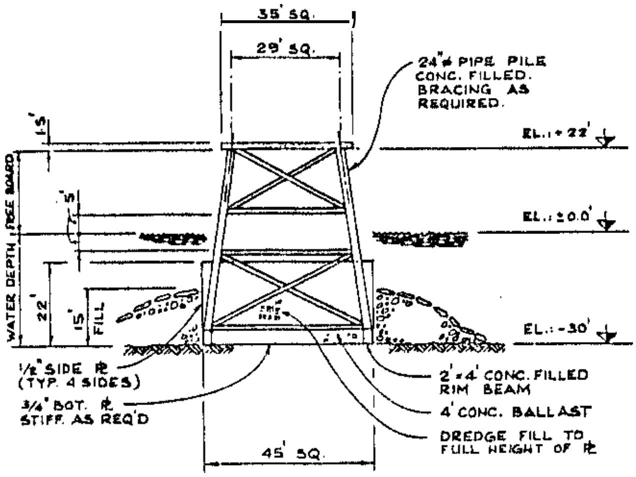


8 FLOATABLE STEEL PILES ·
STEEL BASE (ALT. A)

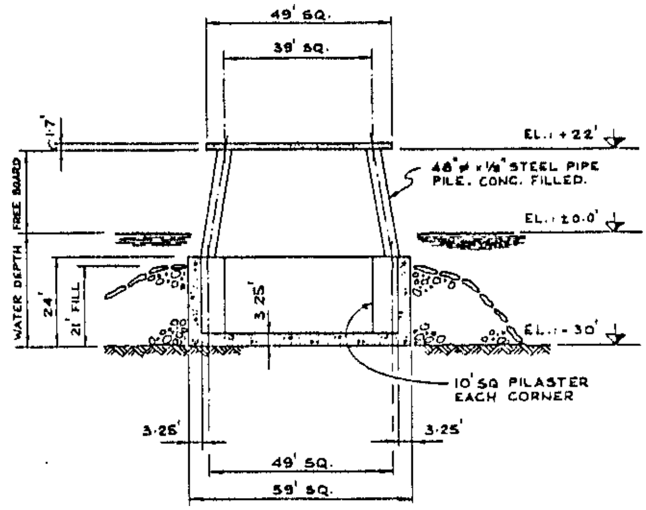
CAUSEWAY

SUPPORT STRUCTURE SCHEMES (cont.) FIGURE C-2.5

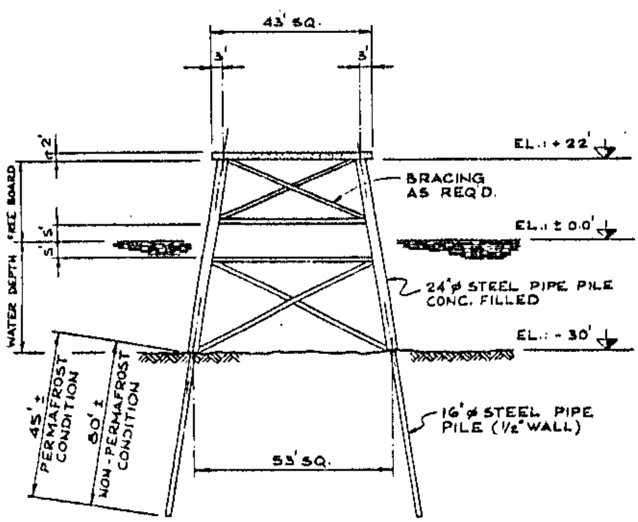
(STRUCTURAL CAUSEWAY ALTERNATIVE)



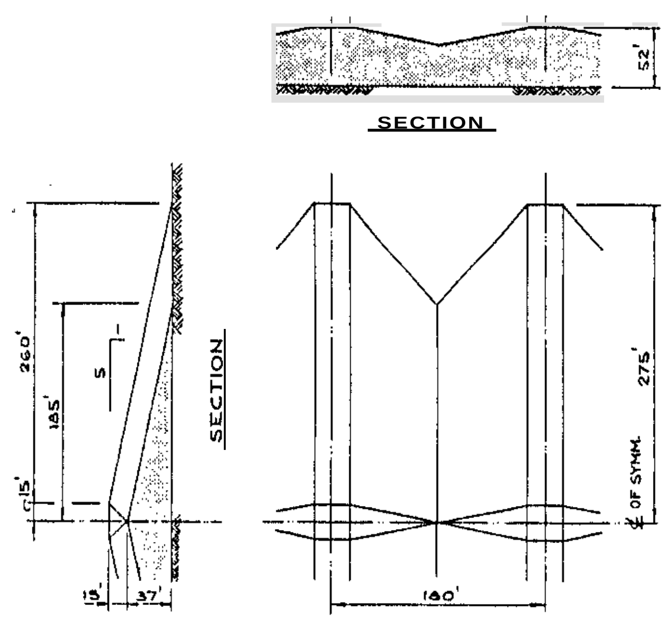
9 FLOATABLE STEEL PILES - STEEL BASE (ALT. B)



10 FLOATABLE STEEL PILES - CONCRETE BASE



11 JACKET TYPE STRUCTURE



12 GRAVEL ISLAND,

CAUSEWAY SUPPORT STRUCTURES SCREENING MATRIX (STRUCTURAL CAUSEWAY ALTERNATIVE)

TABLE C-2.6

SCHEME \ WEIGHT	SHOP COST	SHOP TIME	TRANSPORTATION COST	TRANSPORTATION TIME	FIELD COST	FIELD TIME	STRUCTURAL PERFORMANCE SHORT TERM	STRUCTURAL PERFORMANCE LONG TERM	TOTAL COST	FLOATABILITY	WEIGHTED RATING	RANK
	RATING/PRODUCT											
WEIGHT	4	2	4	4	5	8	8	10	9	5		
1	0/0	0/0	4/16	4/16	1/5	2/16	8/64	8/80	8/72	0/0	269	7
2	4/16	2/4	2/8	2/8	5/25	6/48	8/64	10/100	9/81	5/25	379	1
3	4/16	2/4	2/8	2/8	5/25	6/48	8/64	10/100	7/63	5/25	361	2
4	4/16	2/4	2/8	2/8	5/25	6/48	8/64	10/100	3/27	5/25	325	4
5	4/16	2/4	2/8	2/8	5/25	6/48	8/64	10/100	2/18	5/25	316	5
6	4/16	2/4	2/8	2/8	5/25	6/48	8/64	10/100	1/9	5/25	307	6
7	4/16	2/4	2/8	2/8	5/25	6/48	8/64	10/100	3/27	5/25	325	3
8	4/16	2/4	2/8	2/8	5/25	6/48	7/56	3/30	5/45	5/25	265	8
9	4/16	2/4	2/8	2/8	5/25	6/48	5/40	1/10	7/63	5/25	247	10
10	4/16	2/4	2/8	2/8	5/25	6/48	7/56	3/30	4/36	5/25	256	9
11	4/16	2/4	3/12	2/8	3/15	4/32	5/40	1/10	9/81	0/0	218	12
12	0/0	0/0	3/12	4/16	0/0	0/0	8/64	9/90	6/54	0/0	236	11

2.3 DESCRIPTION OF SELECTED SCHEMES

From the screening matrices, the desirability of each scheme was determined from its ranking. The highest ranking scheme for each type of structure was chosen for further engineering evaluation. They are:

Berthing Facilities - Concrete Retaining Wall

Causeway (Primary Recommendation) - Solid Fill w/Armor Rock

Causeway (Alternative Recommendation)

- For Superstructure - Precast Prestressed Decked Bulb Tees

- For Support Structure - Concrete Box-Base Monopod

For the berthing facilities, the concrete caisson acting as a retaining wall was selected, because this type of construction has the advantage of low total cost and minimal field time required for placement. The concrete caisson box sections with internal stiffening walls would be manufactured in a graving dock and transported to the site by submersible barge or by towing. The caissons would be placed in position and grounded by filling with suitable sand and gravel. Fill material topped with slope protection would be placed between the caissons to provide the dock surface. The structure relies on soil friction and passive resistance from retained earth to resist ice loads.

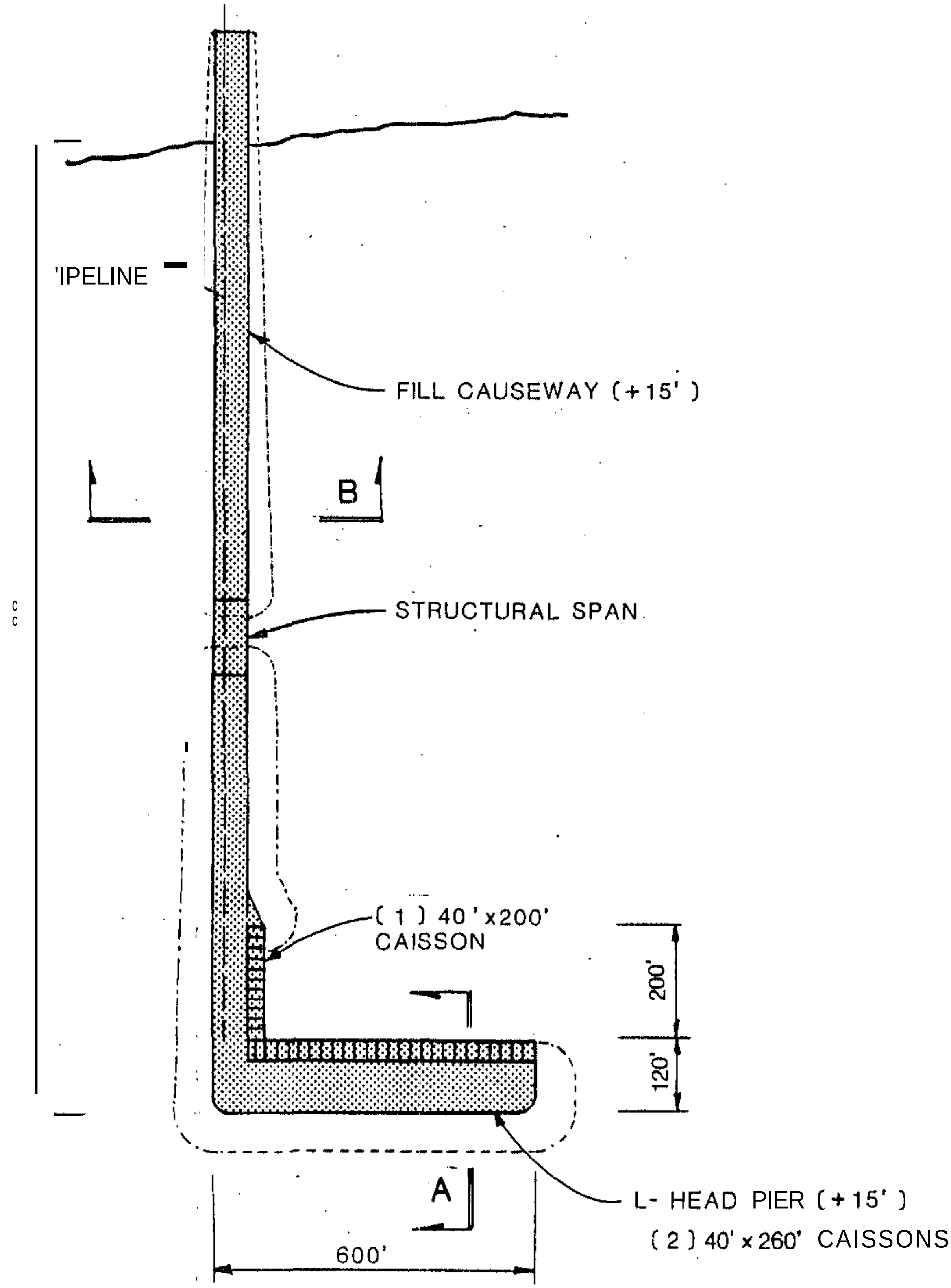
Although a filled causeway is recommended, structural alternatives were considered, in the event that rock or gravel is not available in sufficient quantities, or in the event that the environmental effects associated with a filled causeway are deemed unacceptable.

For the spans of the alternative structural causeway superstructure, the precast, pre-stressed decked bulb tees were selected. The precast girders would be manufactured under controlled conditions and would be stored until needed. This system has the simplest construction requirements, and the top flange of the tees provides a working surface when the girders are erected. Precast concrete offers a distinct advantage over steel in maintenance and corrosion resistance. The girders would be manufactured in a precasting plant and transported to the site on barges. They would then be erected on the causeway support piers and joined together with post-tensioned diaphragms.

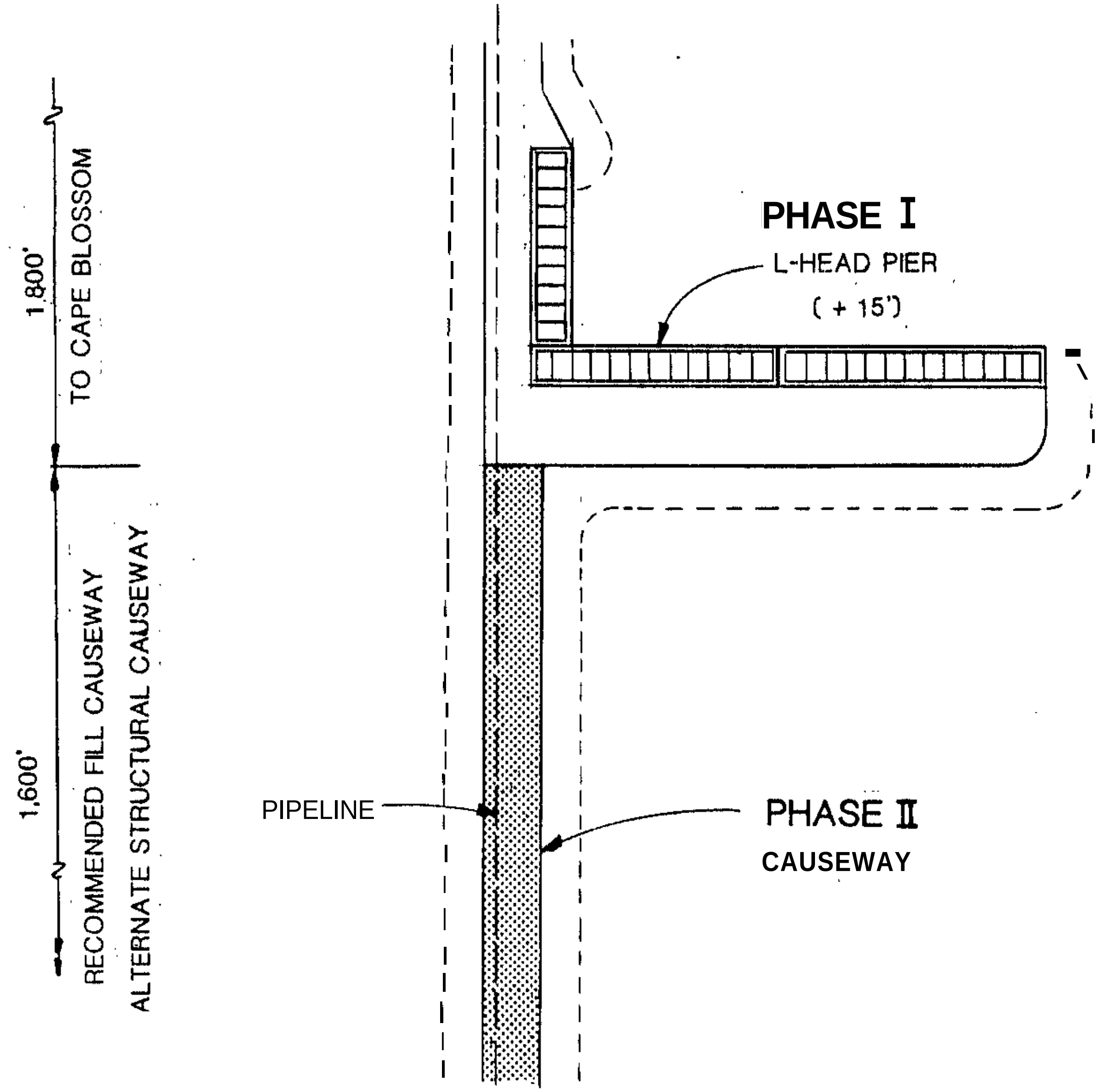
The concrete box-based monopod was selected as the best support structure for the alternative structural causeway. This scheme has the advantages of low cost, short placement time, and superior resistance to marine forces and corrosion. 'The concrete structure would be precast in a graving dock and transported to the site. The monopod would be grounded in position by filling the base structure with suitable material. Side berms of fill material topped with slope protection would be placed around the base, if required, after soils tests.

Figures C-2.6 through C-2.10 illustrate these selected schemes.

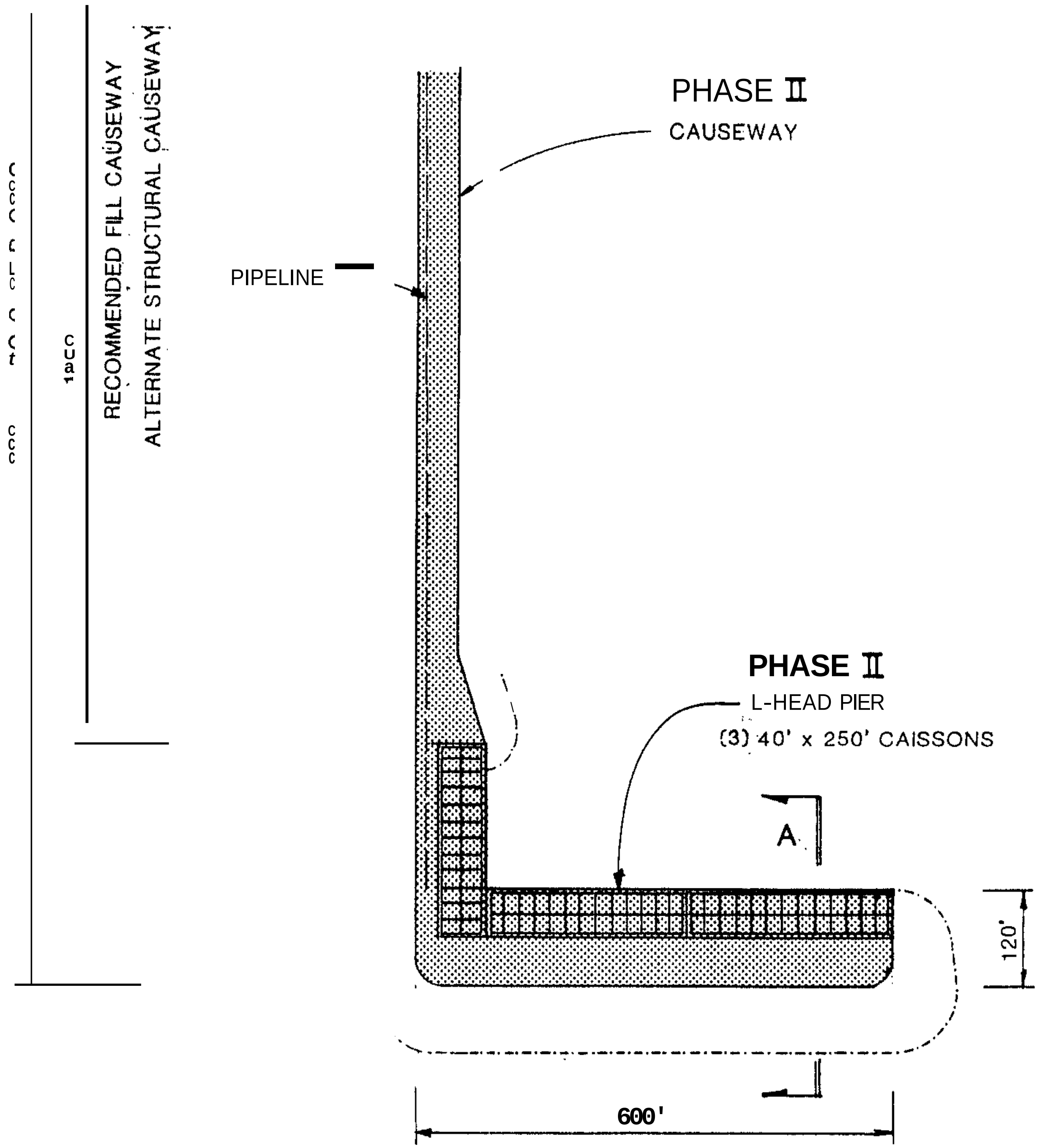
PHASE I L-HEAD PIER & CAUSEWAY FIGURE C-2.6



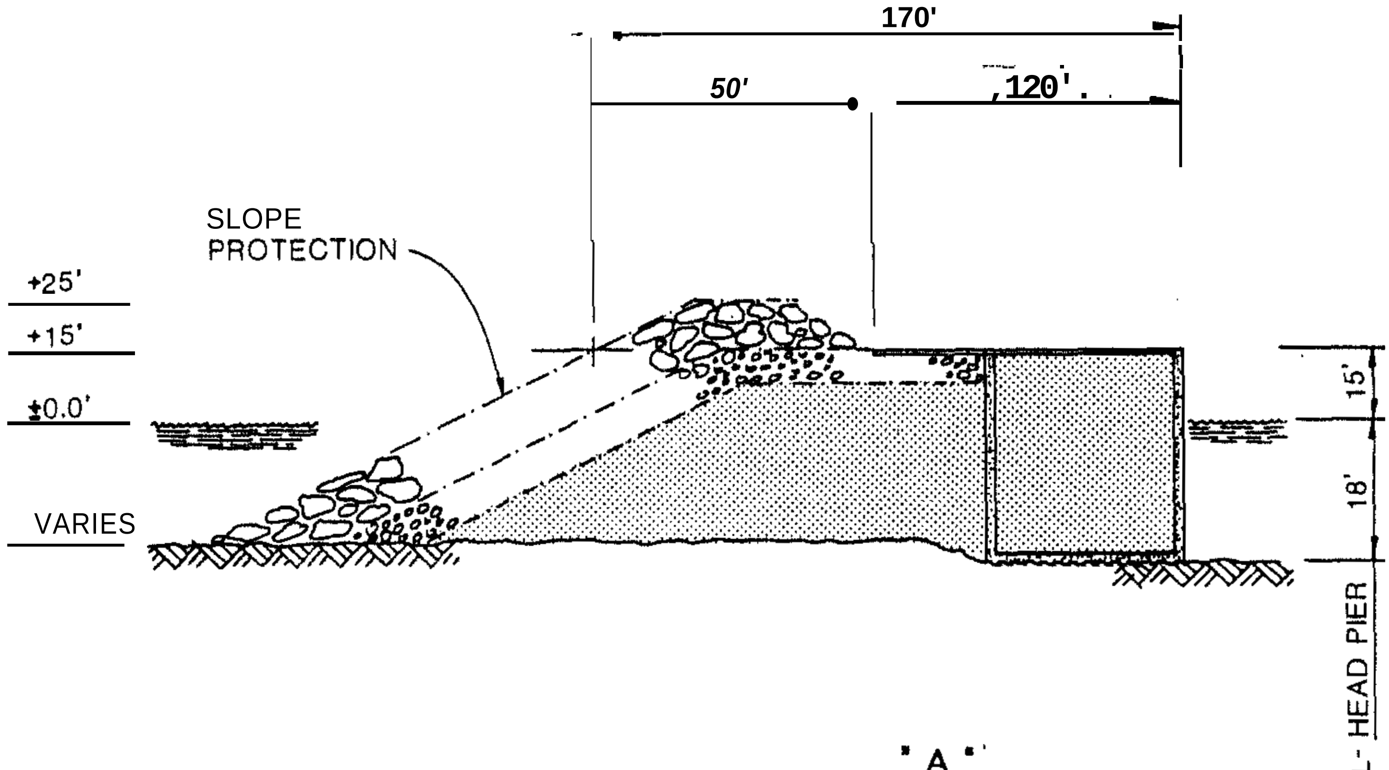
PHASE II CAUSEWAY EXTENSION FIGURE C-2.7



PHASE II CAUSEWAY & OUTER PIER FIGURE C-2.8



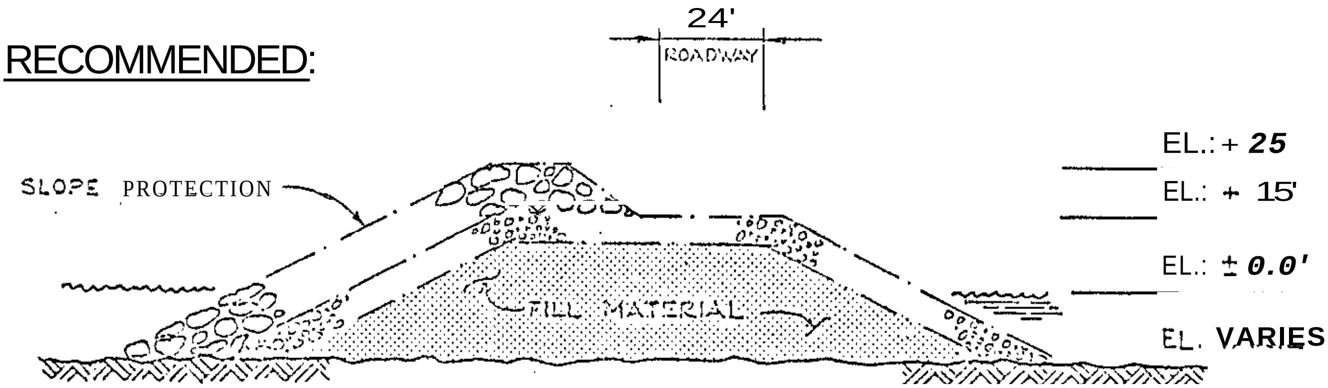
BERTHING FACILITIES SECTION FIGURE C-2.9



SECTION "A"

CAUSEWAY SECTIONS FIGURE C-2.10

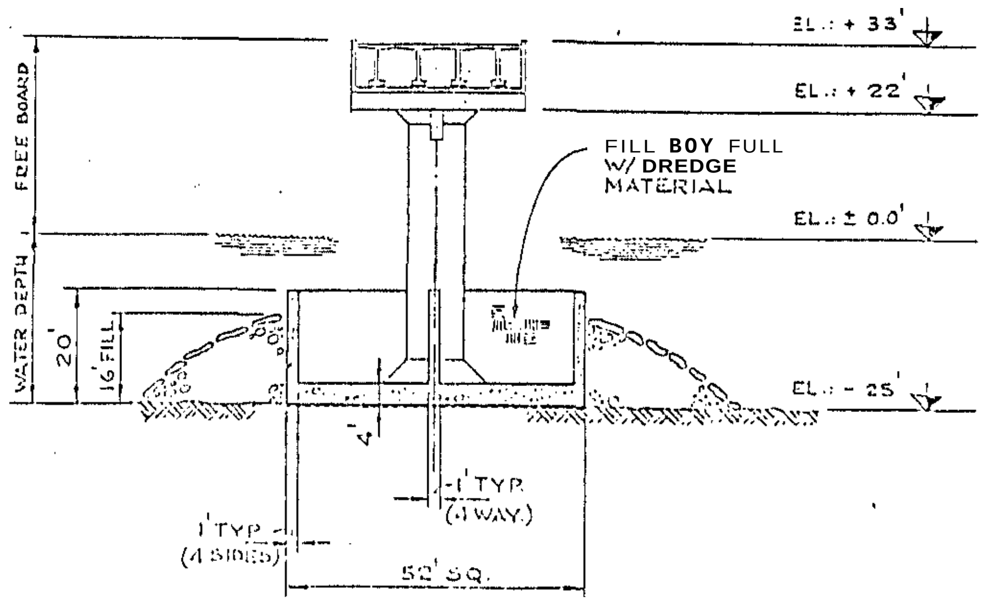
RECOMMENDED:



SECTION "B"

(FILL CAUSEWAY)

ERNA :



SECTION "C"

(STRUCTURAL CAUSEWAY 1

3.0 FACILITIES PLANNING - ONSHOKE

3.1 PHASED DEVELOPMENT OVERVIEW

On-shore facilities at Cape Blossom would be developed in phases to coincide with port development and anticipated increases in shipping. This section describes how port activities and functions would gradually shift from Kotzebue to Cape Blosssom as facilities are developed to handle increased shipping at Cape Blossom.

The present port facilities at Kotzebue are owned and operated by Arctic Lighterage. The location of the existing port is shown on Figure C-3.1. This discussion is based on initially continuing to use these facilities until replacement facilities are available at Cape Blossom; eventually most port activities would be transferred to Cape Blossom, at which time the Kotzebue site would be used to transship supplies to up-river villages. Over time, most of the existing port area would become available for sub-leasing of space and buildings, which could reduce activity conflicts within the city by developing compatible business uses in the area.

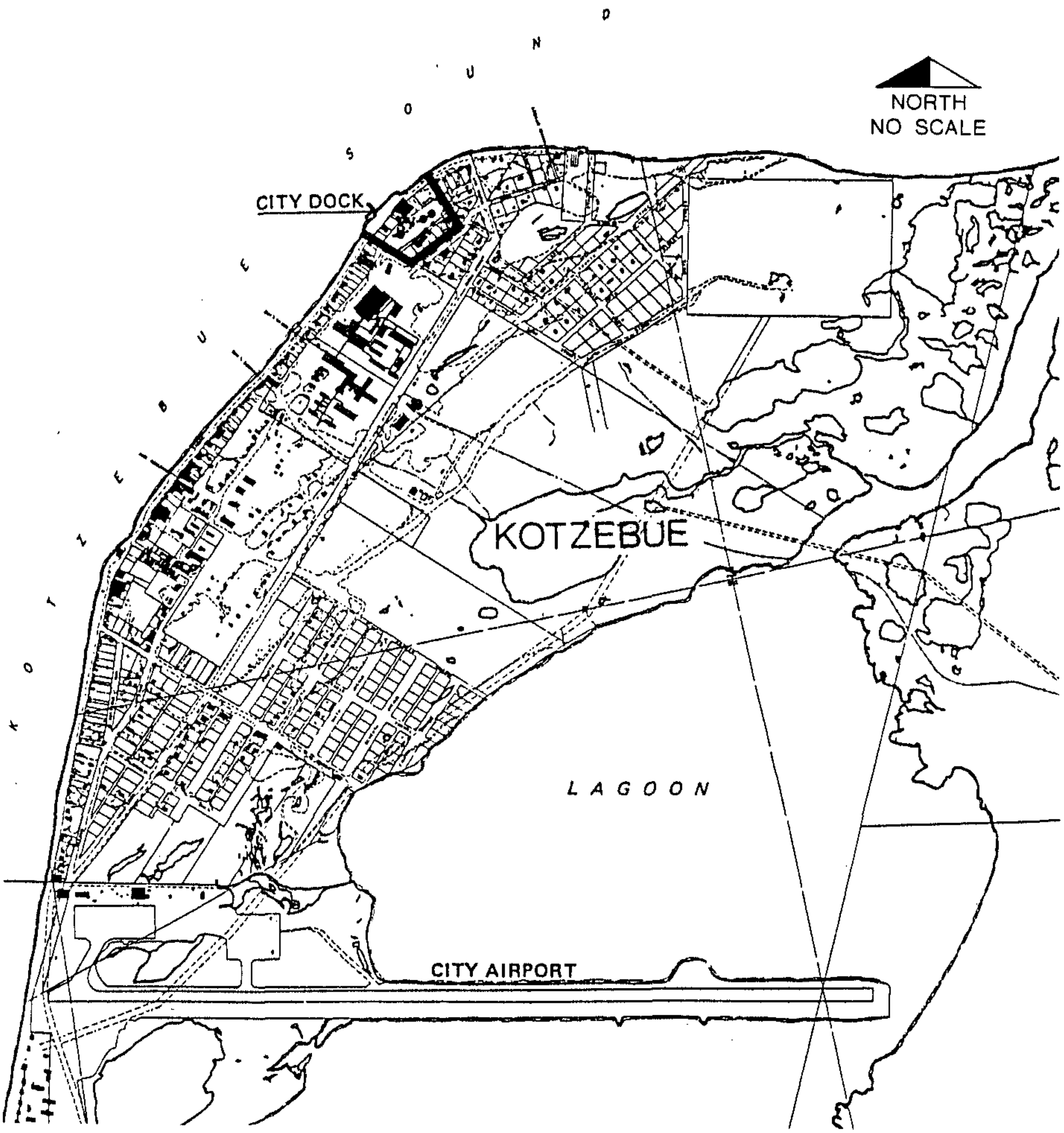
Independent of development of new port facilities at Cape Blossom, there exists a strong desire to relocate the existing tank farm from the Port of Kotzebue. The existing Chevron Oil tank farm could be relocated to a point outside town to eliminate the safety hazard that now exists. The relocated tank farm capacity would provide surge capacity for local short term needs. This is subject to negotiation with Arctic Lighterage, and it is understood that marginal profitability exists for oil supply to Kotzebue; relocation of the tank farm may be infeasible for private investment unless subsidized or supported by additional charges.

An overriding consideration in developing the new port at Cape Blossom is to be able to offload vessels directly and expeditiously in all weather conditions. Immediate storage for cargo, including fuels, would be provided at Cape Blossom for transshipment by truck or, preferably, by pipeline to Kotzebue. Initially, facilities at Kotzebue would continue to be used to store and handle cargo for transshipment and for local storage, until the volume of cargo increases to the point where additional facilities would be needed at Cape Blossom. Eventually, increased shipping and the anticipated development of mining and oil exploration operations in the region would require substantial areas for bulk storage and cargo handling at Cape Blossom.

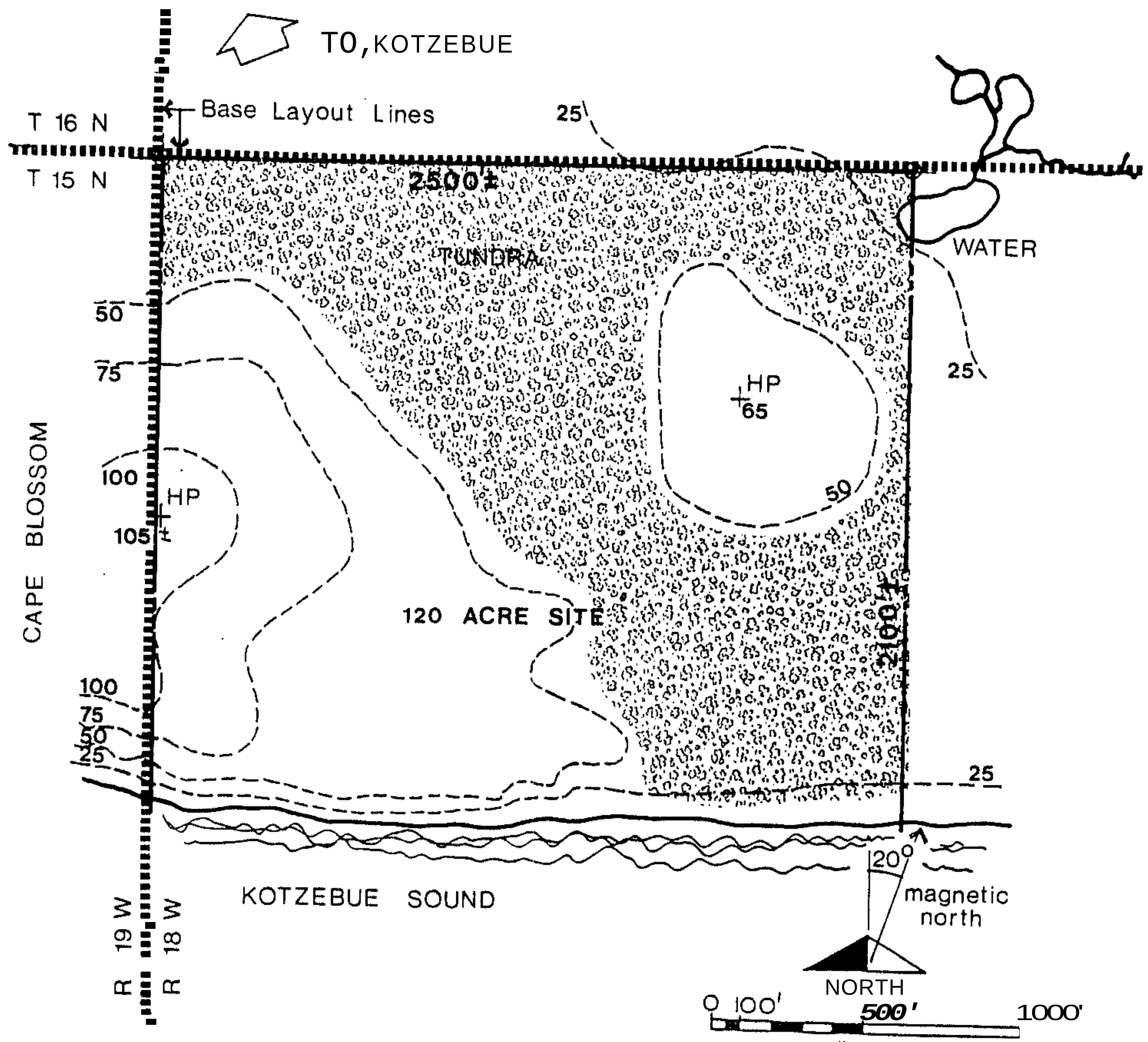
Existing topographic, drainage, and vegetative conditions at the Cape Blossom site are shown on Figures C-3.2 and C-3.3. These conditions influenced the recommended facility layout options for the area. The eventual configuration of on-shore facilities is shown on Figures C-3.4 and C-3.5.

Development of on-shore facilities would occur in two phases to coincide with development of Phase I and II development of port structures. These will now be described.

KOTZEBUE PORT (EXISTING) FIGURE C-3.1



EXISTING CONDITIONS:
ELEVATIONS/VEGETATION FIGURE C-3.2

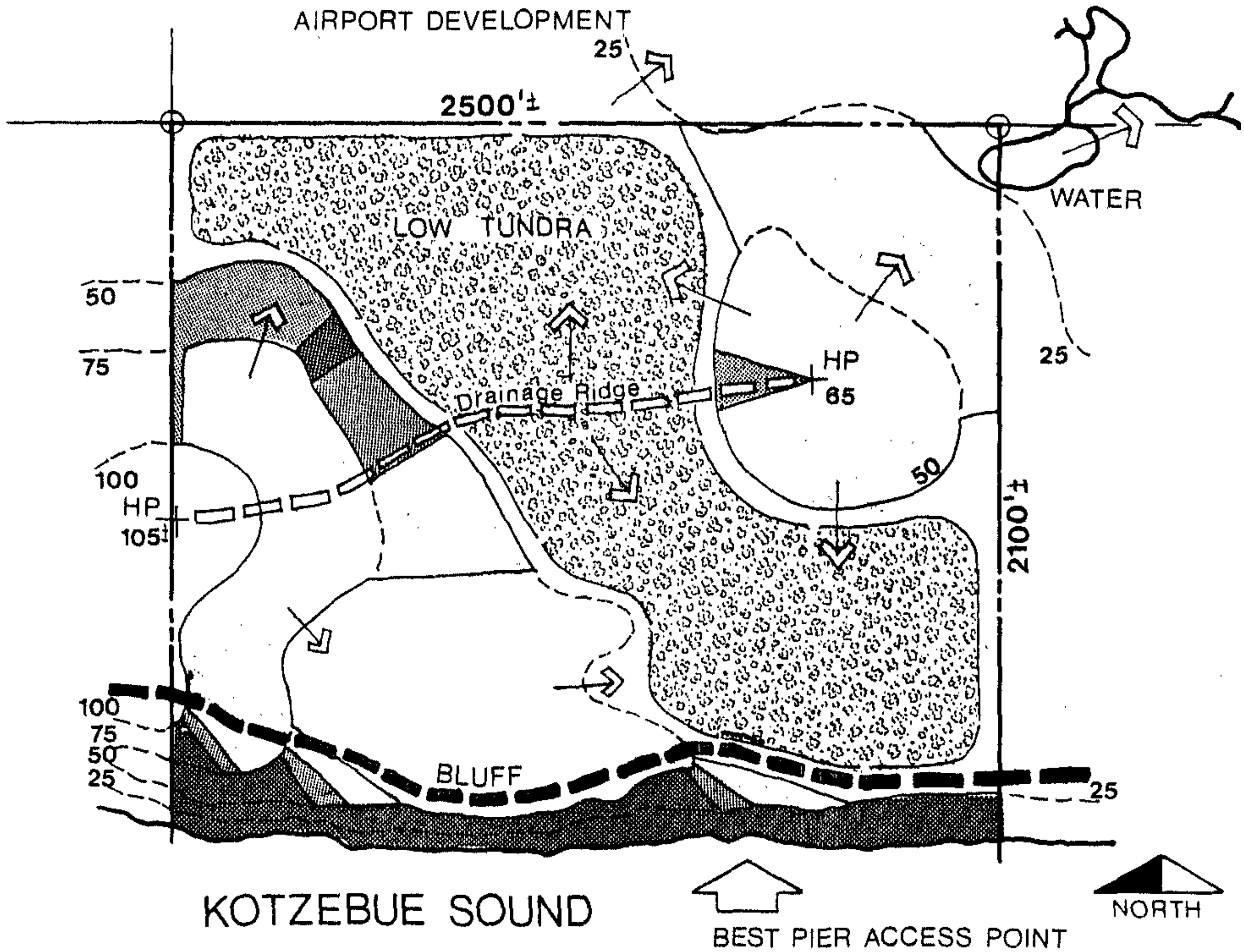


Scale 1" = .1 mile = 528'.
Contour Interval 25'.

Latitude. 66° 45' N
Longitude · 162° 30' E

NOTE– Base Information from USGS Kotzebue (D-1) Alaska 1950–1951.

EXISTING CONDITIONS: SLOPE/SOILS FIGURE C-3.3



LEGEND

0 – 5%
5 – 10%
10 – 15%
15% +
Questionable Soil
Drainage Flow.

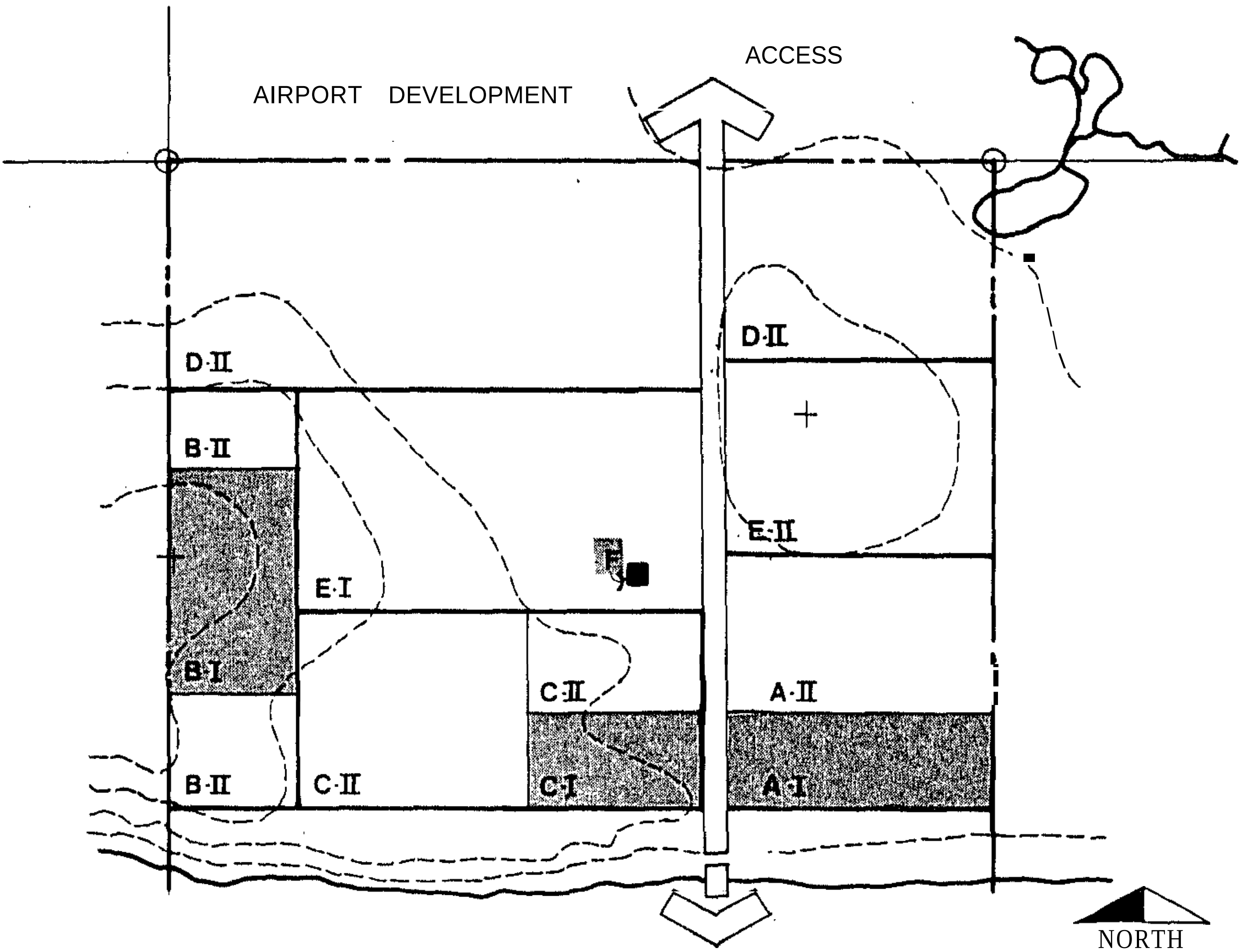
0 100' 500' 1000'

Scale 1" = .1 mile = 528'
Contour Interval 25'.

NOTE – **Base** Information from USGS Kotzebue (D–1) Alaska 1950–1951.

DEEPWATER PORT
ON-SHORE FACILITIES PLAN

FIGURE C-3.4



PHASE-I – 14.0 acres.

Scale 1" = .1 mile = 528'.

Contour interval 25'.

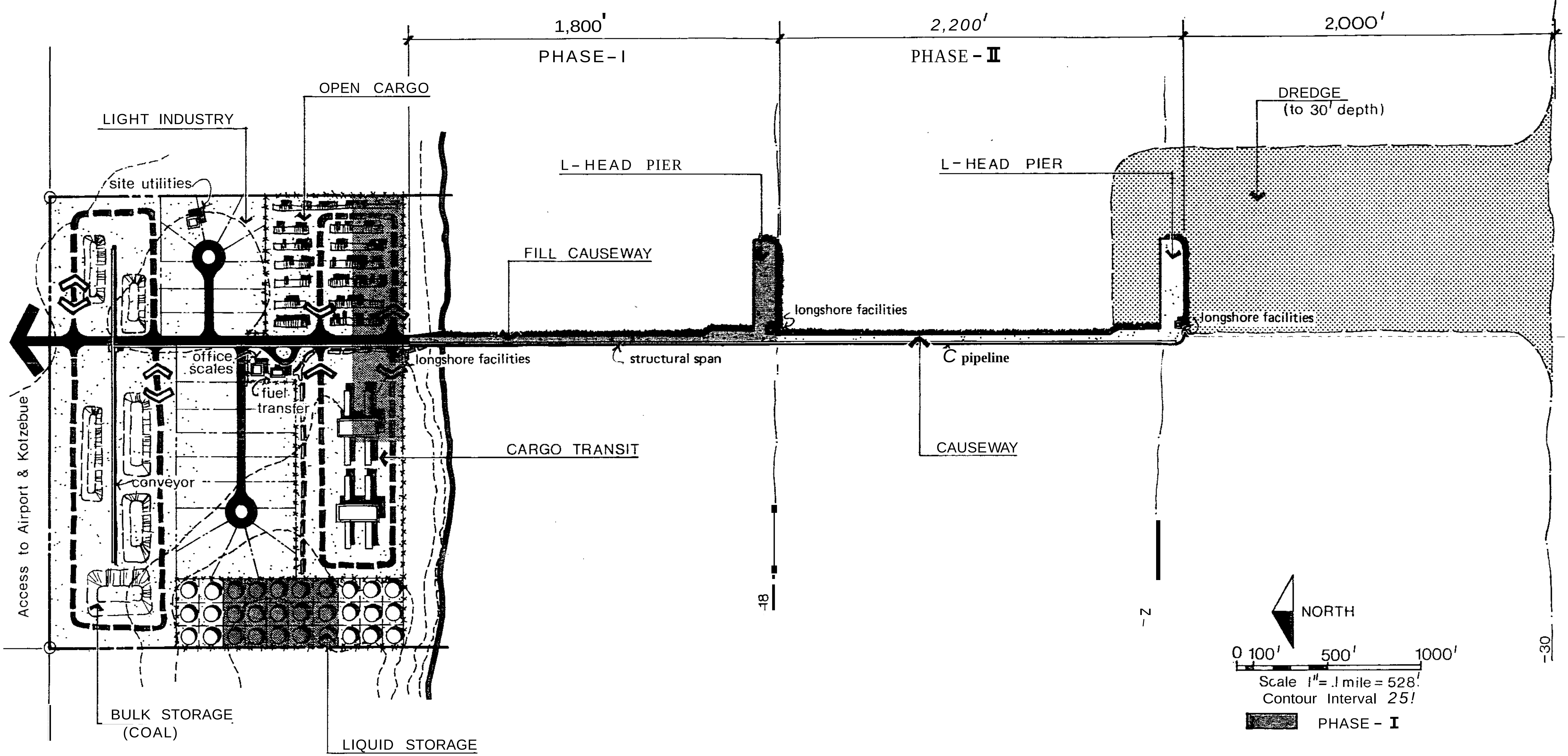
use	Open Cargo		Liquid Storage		Cargo Transit		Bulk Storage		Light Industry	
phase	A·I	A·II	B·I	B·II	C·I	C·II	D·II	D·II	E·I	E·II
area *	4.8	8.6	6.0	4.9	3.2	12.1	21.8	11.2	15.8	11.6
total area *	13.4		10.9		15.3		33.0		27.4	

F Fuel Transfer Station.

* in acres.

DEEPWATER PORT FACILITES

FIGURE C-3.5



3.2 PHASE I DEVELOPMENT

Upon completion of Phase I, cargo and fuel barges up to 16 feet of draft could berth directly. Most port operations would relocate to Cape Blossom.

Phase I development at Cape Blossom would include:

- An 1,800 foot causeway and 500 foot dock.
- A three mile access road to site from highway.
- On-shore fuel tanks sufficient to off-load a barge containing oil, diesel.fuel, and gasoline.
- The existing tank farm at Kotzebue would be removed. A smaller tank farm would be located just outside the city.
- A POL pipeline between Cape Blossom and Kotzebue or facilities for loading fuel tank trucks for transport to the relocated Kotzebue tank farm.
- A 12,000 square foot transit building to contain other commodities until they can be trucked to Kotzebue.
- Outside storage or a building to house construction materials, pending transport to Kotzebue.
- Provision of facilities to transport heavy equipment and cargo containers directly to a secured area within Kotzebue's port facility.
- Bulk storage areas set aside for future bulk materials, such as coal and ore.

- A mobile crane which can traverse the causeway and off-load cargo.

- Utilities needed: electrical power, water, sanitary facilities.

Under this phase, the existing warehouse facilities at Kotzebue would continue to be used for transshipment, repackaging and for local storage. The port shipping offices and administration buildings would remain at Kotzebue.

The first phase of development would use Arctic Lighterage Company's existing buildings at the Port of Kotzebue for breakbulk, transit, and warehousing for both local use and transshipment.

The present Chevron tank farm could remain in operation, or new tank storage facilities could be provided at a location near, but outside, the City of Kotzebue. New tank storage facilities would be designed to accommodate anticipated future local surge storage needs, with the main storage tanks located at Cape Blossom. If such new tank storage is provided near Kotzebue, the existing Chevron tank farm could be removed.

The present Chevron tank farm in Kotzebue provides the following capacities:

Unleaded Gasoline	253,000 gal
Regular Gasoline	776,000 gal
Aviation Gas (100 Octane)	855,000 gal
Aviation Gas (80 Octane)	108,000 gal
Jet Fuel (A50)	1,796,000 gal
Diesel #1 & Heating #1	1,435,000 gal
Diesel #2	932,000 gal

These fuels are stored in 13 tanks, with a full transfer station installation. Aircraft fuels are presently transshipped to the airport as needed.

Fuel for the public utility district's electrical power generator is stored in a separate 1,000,000 gallon tank located outside the town.

The existing tank farm in Kotzebue could store all the fuels necessary to supply Kotzebue and transshipment needs. Because of the hazardous conditions now existing, however, it would be desirable to relocate this tank farm elsewhere. If this is done, this minimum amount of surge tank storage should be provided at the new location near Kotzebue:

Unleaded Gasoline	20,000 gal
Regular Gasoline	40,000 gal
Diesel #1	40,000 gal
Diesel #1	40,000 gal
Diesel #2	40,000 gal
Electrical Generator (existing)	1,000,000 gal

Tank Capacity at the new on-shore location at Cape Blossom would be:

Unleaded Gasoline	500,000 gal
Regular Gasoline	1,000,000 gal
Diesel #1	1,000,000 gal
Diesel #1	1,000,000 gal
Diesel #2	1,000,000 gal
Aviation fuel (100 Octane)	1,000,000 gal
Aviation fuel (80 Octane)	200,000 gal
Jet fuel	2,000,000 gal

Initially, tank trucks could be used to service the Kotzebue airport from tank storage at Cape Blossom. Aviation fuel storage tanks could later be located at the existing airport to provide faster service. Approximately 1,000,000 gallons of storage for aviation gas and 2,000,000 gallons for jet fuel would be needed at the airport in order to satisfy present traffic. If a new airport is built adjacent to the Cape Blossom port, tanks could also be located there: it would be possible to pump directly from off-loading barges to the storage tanks at the new airport.

With the new tank farm near Kotzebue and the new tank farm at Cape Blossom, substantial valuable land would be made available at the vacated Chevron tank farm site.

The existing buildings at the Port of Kotzebue site could be used for transshipment activities. The 40-foot by 60-foot and the 40-foot by 100-foot buildings owned by Arctic Lighterage could also be used for breakbulk activities and warehousing. They are, however, unheated. An administrative office and employee facilities would be required and could be accommodated in the existing 40-foot by 60-foot frame building. This building and a 30-foot by 60-foot frame building used for the dock office are heated and lighted. Additionally, there is a 20-foot by 30-foot wood frame Rope House, a 25-foot by 40-foot lumber warehouse, and a 20-foot by 30-foot tire house. These buildings serve all present shipping activities; some would become excess to needs as the Kotzebue Dock reverts to a transshipment facility.

Table C-3.1 shows the existing building inventory and present uses, which could continue through Phase I.

Fire protection to the Port of Kotzebue is provided by the fire truck stationed at the nearby airport.

The present crawler crane, fork-lift trucks, and truck-trailer rigs owned by Arctic Lighterage could continue to be used for handling cargo on-site, and trucks could be used for hauling cargo from Cape Blossom. The present motor patrol could be used for maintaining gravel roads and controlling snow. A snow plow would be needed to clear heavy drifts.

At Cape Blossom, undeveloped land is available for on-shore facilities. During Phase I, the new tank farm and a 12,000 square foot transit building would be constructed. The transit building would have enclosed dock space for five truck lanes and would also contain administrative and shipping offices, a caretaker's station, and transit storage space for dry cargo and commodities. An open storage area would also be provided, with security fencing, lighting, and an alarm system. Access to the causeway and pier would be secured by a locked gate and alarm system.

Minimum utilities would also be provided in Phase I. Water would be supplied from a stream or lake, with treatment, plus storage sufficient for the winter season. Sanitary sewage would be provided by a holding tank, which would be periodically pumped and trucked to a dump site. Electricity would be provided by a Jacobs-type wind generator, with diesel generator back-up. Telephone service would be provided by a ground station system.

Approximately three miles of access road would be needed to connect Cape Blossom to the proposed Kotzebue-Cape Blossom Highway. Final location of the access road would depend on the location of the future airport's terminal location and on the physical restrictions of the terrain.

A summary of phased development of facilities and operation is contained on Table C-3.2. A discussion of development anticipated for Phases II follows.

ARCTIC LIGHTERAGE BUILDINGS AT PORT OF KOTZEBUE — Table C-3.1

BUILDING	TYPE	SIZE	HEAT	LIGHT	USE: PHASE I	USE: PHASE II
Storage	Metal	40 x 100	NO	No	Warehouse	Lacal Commodity Storage
Storage	Metal	40 x 60	NO	No	Breakbulk	Not Needed
Office	Wood	40 x 60	NO	No	Admin.	Not Needed
Dock Office	Wood	30 x 60	Yes	Yes	Shipping	NOt Needed
Rope House	Wood	30 x 30	NO	No	Rope House	Not Needed
Lumber Warehouse	Wood	25 x 40	NO	No	Lumber Warehouse	Local Commodity Storage & Building Supplies
Tire House	Wood	25 x 30	No	No	Tire House	Local Commodity Storage & Building Supplies
Parts & Welding Shop	Wood	100 x 100	Yes	Yes	parts & Welding	Parts & Welding

PHASED DEVELOPMENT OF FACILITIES AND OPERATIONS Table C-3.2

Legend: K - Kotzebue   1 - Existing facility at Kotzebue
B - Blossom   2 - New facility to be provided
3 - Facility to be enlarged

example - Transit Shed: Under Phase I, the existing transit shed at Kotzebue will be used and a new one built at Cape Blossom. Tne new transit shed will be enlarged in Phase 11.

FACILITY/OPERATION:	PHASES I	II
Transit Shed	K_1 & B_2	B_3
Transshipping	K_1	B_2
Break Bulk	K_1	B_2
Warehouse (12,000 sq.ft)	K_1	B_2
Admin. Offices	K_1	B_2
Office/Shipping	K_1	B_2
Longshore Building	K_1 & B_2	B_3
Containers & Storage	K_1	B_2
Gate Building	K_1	B_2
Scales	K_1	B_2
Equip. Maint. Facilities	K_1	B_2
Security Building	B_2	B_2
Tank Farm	B_2	B_2 or 3
Surge Tanks	K*	K*
Coal Terminal	-	B_2
Ore Handling, Storage	-	B_2

* - existing Chevron Tank Farm is to be removed in Phase I and a small surge tank farm provided outside but adjacent to Kotzebue. These surge tanks would be used in Phases I and 11.

3.3 PHASE II DEVELOPMENT

Phase II development would be triggered by coal and other mineral development or OCS activities in the region, which would increase shipping, cargo handling, fuel storage, bulk storage, and possibly crude oil storage requirements.

Phase II development envisions all port functions being at Cape Blossom, including coal export and outer continental shelf oil support activities. Only the upriver village transshipment function would remain at Kotzebue; this would free all but about one acre of the present Kotzebue port site for sub-leasing and other development. The small transshipment facility at Kotzebue would require a small storage building, shipping office, and mobile crane. Transshipment cargo would be made up at Cape Blossom and trucked directly to Kotzebue for barge loading.

The new facilities at Cape Blossom would include additional warehouse space and transit buildings, maintenance facilities and garage, a shipping office, longshore office, security office, gate building, and truck scales. Coal or ore storage areas would be developed, and conveyors and related Eacilities would be provided for loading bulk carriers at the Outer pier. Should Chukchi Basin/Hope Basin development occur following OCS explorations, it is very likely, in the opinion of this consultant, that transport of oil will be most economical. via pipeline to the Kotzebue area and thence by ice-reinforced tanker to Uniat Pass (Aleutian/Alaska Peninsula), with transfer to conventional tankers at that point. Economics and environmental constraints do not favor pipelines east to TAPS. If such an activity were to occur, major expansion of the backlands area would be required for tank storage for the ice-bound win'ter months.

All this development at Cape Blossom, and the transfer of all port operations would tend to stimulate development oL relocation of related businesses to the new site.

Figures C-3.4 and C-3.5 show how the completed on-shore development would be laid out. Under this Phase:

- The causeway would be extended to a second L-head pier 4,000 feet from shore in 25 feet of water (dredging would provide 30 feet of water depth to accommodate vessels of up to 22 feet of draft).

- Coal, oil, or ore storage areas, conveyors, and related facilities would be developed.

- The tank farm would be expanded to handle all fuels, including airport needs.

- Additional open-storage, warehouse space, and transit buildings; maintenance facilties and garage: shipping, longshore, and security offices: a gate building; and truck scales would all be provided.

- Welding and fabrication shops (to serve industries at Cape Blossom) may be provided.

- Full security measures would be provided, which would include fencing, lighting, alarm systems, and probable full-time security guards.

- All utilities would need to be expanded, to include: potable water supply and storage, tertiary sanitary sewer treatment with outfall in Kotzebue Sound, and additional electrical power from wind and diesel powered generators.

Table C-3.3 shows equipment requirements for Cape Blossom and Kotzebue, as projected through the year 2000. Table C-3.4 shows a summary of projected building needs during the phased on-shore development.

EQUIPMENT REQUIREMENTS AT KOTZEBUE AND CAPE BLOSSOM** Table C-3.3

	AT KOTZEBUE	AT CAPE BLOSSOM	TO SERVE BOTH SITES
Phase I:	Crawler Crane	Mobile Crane	Fuel Tank Truck
	1 Hvy Forklift	1 Hvy Forklift	2 Flat bed Trucks
	1 Med Forklift	1 Med Forklift	1 Van Truck
	* Fire Truck	Snow Rem. Equip.	
Phase 11:	Crawler Crane	Mobile Crane	Fuel Tank Trk/Trlr
	1 Hvy Forklift	2 Hvy Forklifts	2 Flatbed Trucks
	1 Med Forklift	2 Med Forklifts	1 Van Truck & Trlr
	* Fire Truck	Snow Rem. Equipment	
		Fire Truck	

* Fire truck at Kotzebue airport Serves port

** Through the Year 2000.

CAPE BLOSSOM BUILDING PROJECTION

Table C-3.4

New Building or Addition	Heated	Lighted	PHASE I sf	PHASE II sf (added)
Transit Building	Yes	Yes	12,000	16,800
Warehouse	. No	Yes	------	24,000
Admin. Building	Yes	Yes	------	3,000
Shipping Office, Longshore facility & Security Office	Yes	Yes	------	3,200
Longshoremen's Bldg. on pier	Yes	Yes	800	------
Equipment Maintenance and Garage Facility	Yes	Yes	------	4,200
Truck Scales	NO	Yes	------	10'x40'
Gate Building	Yes	Yes	------	120

4.0 COSTS OF PORT DEVELOPMENT

Costs of development of a new deepwater port are presented below. Offshore development costs are discussed in Section 4.1; onshore costs are presented in Section 4.2.

4.1 OFFSHORE DEVELOPMENT COSTS

Two basic approaches to port development were considered, in order to allow a meaningful comparison of costs. One approach would provide single-phase construction of a 4,000 foot long rubble-mound causeway to an L-head pier. Its costs are summarized in Table C-4.1.

The recommended approach calls for a two-phase development scenario keyed to shipping needs. Phase I would provide an 1,800 foot causeway to an L-head pier; this development would meet Kotzebue current shipping needs. Phase II would extend the causeway 2,200 feet to a second L-head pier in deeper water; this development would serve future shipping needs. Estimated costs of this two-phase approach are summarized in Table C-4.2. Detailed costs for Phase I are presented in Table C-4.3, and detailed costs for Phase II are presented in Table C-4.4. Table C-4.5 displays estimated cost of the structural alternative for the extended causeway.

4.2 ONSHORE DEVELOPMENT COSTS

Estimated costs for onshore support facilities are summarized in Table C-4.6 and are shown in more detail in Table C-4.7. In addition, the cost of a fuel transfer pipeline system connecting Cape Blossom and Kotzebue is estimated at $14 million.

TABLE C-4.1

COST OF SINGLE-PHASE CONSTRUCTION OF 4000 FOOT RUBBLE-MOUND CAUSEWAY TO PIER AT 30 FEET OF WATER DEPTH (NOT RECOMMENDED)

Item	Quantity	Unit	Unit cost	Total Cost (Thousands)
Core Material	604,000	CY	40	$24,160
Armour Rock	134,000	CY	EO	10,700
Under Layer	82,000	CY	50	4,100
Concrete Caisson	12,750	CY	900	11,500
Caisson Shipping & Installation		LS		2,500
Bridge Section	100	LF	80	80
Bridge Shipping & Installation		LS		40
Bridge Abutments		LS		500
Channel Dredging		LS		3,000
Sub Total				56,580
Contingency & Engineering @ 20%				11,316
Total				$67,E96

SUMMARY OF ESTIMATED COSTS, RECOMMENDED PLAN* TABLE C-4.2

		Total Cost (Thousands)
Phase I:	1,800 foot solid-fill causeway and L-Head pier at 18 foot water depth:	$34,861
Phase II:	2,200 foot extension of solid fill causeway and second pier at 30 foot water depth:	51,458
	Total Project Cost	$86,319
Structural option for causeway extension (add):		4,442
Total Project Cost, Structural Option:		$90,761

* Summarized Tables C-4.3, C-4.4, and C-4.5

PHASE I 1,800' LONG RUBBLE-MOUND CAUSEWAY AND PIER DEPTH, ESTIMATED COSTS

TABLE C-4.3

Item	Quantity	Unit	Unit cost	Total Cost (Thousands)
Core Material	206,600	CY	40	$8,264
Armour Rock	74,400	CY	80	5,952
Under Layer	48,800	CY	50	2,440
Concrete Caisson	9,750	CY	900	8,115
Caisson Shipping & Installation		LS		2,500
Bridge Section	100	LF	80	80
Bridge Shipping & Installation		LS		40
Bridge Abutments		LS		500
Pipeline		LS		500
Sub Total				$29,051
Contingency & Engineering @ 20%				5,810
Total				$34,861

PHASE II: 2,200 FOOT EXTENSION OF CAUSEWAY AND SECOND L-HEAD PIER - ESTIMATED COSTS

TABLE C-4.4

Item	Quantity	Unit	Unit cost	Total Cost (Thousands)
Core Material	327,100	CY	40	$13,084
Armour Rock	103,600	CY	80	8,288
Under Layer	80,700	CY	50	4,035
Concrete Caisson	12,750	CY	900	11,475
Caisson Shipping & Installation		LS		2,500
Pipeline		LS		500
Channel Dredging		LS		3,000
Sub Total				$42,882
Contingency & Engineering @ 20%				8,576
Total				$51,458

PHASE 11: STRUCTURAL CAUSEWAY OPTION - ESTIMATED COSTS

TABLE C-4.5

Item	Quantity	Unit	Unit cost	Total Cost (Thousands)
Core Material	108,900	CY	40	$ 4,356
Armour Rock	36,100	CY	80	2,888
Under Layer	17,800	CY	50	890
Support Structures	9	EA	1.7 mil	15,300
Shipping & Installation		LS		4,000
Superstructure	1,500	LF		1,154
Shipping & Installation		LS		520
Concrete Caisson	12,750	CY	900	11,475
Caisson Shipping & Installation		LS		2,500
Channel Dredging		LS		3,000
Pipeline		LS		500
Sub Total				$46,583
Contingency & Engineering @ 20%				9,317
Total				$55,900

ONSHORE FACILITIES, ESTIMATED COSTS (SUMMARY)*

TABLE C-4.6

Item	Estimated Cost (Thousands)
Fuel Storage at Cape Blossom	$9,360.0
Cargo Transit Building	1,087.0
Open Storage for Containers/Cargo	487.0
Roadway through Site	652.6
Utilities	730.5
New Tank Farm in Kotzebue	1,105.0
New Equipment For Cape Blossom	
Phase I	995.0
Phase II	515.0
Total	$14,932.1

* Detailed Costs are shown on Table C-4.7.

ESTIMATED COSTS, ONSHORE DEVELOPMENT TABLE C-4.7

PHASE I

	Quantity	Unit	Unit Cost	Total Cost (Thousands)
Fuel Storage at Cape Blossom:				
500,000 Steel Tanks	7.5 mil	gal	.75	$5,625
200,000 Steel Tanks	0.2 mil	gal	.75	150
Containment Berms	12,000	CY	40	480
Gravel Insulation	5,000	CY	40	200
6" Dense Styrofoam insul.	4,000	SY	150	600
Site Prep/Excavation	31,000	CY	5	155
Piping/Valves/Controls		LS		1,800
Transfer Station		LS		350
				$9,360
Cargo Transit Building:				
Insul. Metal Building	12,000	SF	50	$ 600
2' Gravel Ballast	7,000	CY	40	280
Security Fence	1,200	LF	30	36
Security Alarm System		LS		50
Grading	2.5	Acre	10/SY	121
				$1,087
Open Storage (Containers/Cargo):				
2' Gravel Ballast	7,000	CY	40	$ 280
Fencing	1,200	LF	30	36
Security Alarm Systems		LS		50
Grading	2.5	Acre	10/SY	121
				$487

ESTIMATED COSTS, ONSHORE DEVELOPMENT (CONTINUED) — TABLE C-4.7

PHASE I (CONTINUED)

	Quantity	Unit	Unit Cost	Total Cost (Thousands)
Roadway through Site:				
Grading	1.5	Acre	10/SY	$ 72.6
18" Ballast	3,500	CY	40	140
6" Crushed Rock	1,000	CY	40	40
Filter Fabric	8,000	SY	50	400
				$652.6
Utilities:				
Electrical				
- 50 KW Diesel Gen.		LS		$ 25
- Wiring/Controls		LS		20
Sanitary Sewer				
- Holding Tank w/Valves	2,000	gal		10
- Piping (insulated)	150	LF	30	4.5
Water Supply (Lake or Creek)				
- Intake Pump (15 GPM)		LS		5
- 3' Ø pipe (insul.)	2,600	LF	25	65
- Storage Tank	20,000	gal		500
- Service piping 1"Ø	500	LF	20	1
Telephones/Communication				
- Ground System		LS		100
				$730.5

ESTIMATED COSTS, ONSHORE DEVELOPMENT (CONTINUED) TABLE C-4.7

PHASE I (CONTINUED)

	Quantity	Unit	Unit Cost	Total Cost (Thousands)
New Tank Farm in Kotzebue:				
Remove existing tanks		LS		$ 200
Regrade site/cleanup		LS		20
Gravel Surface		LS		25
Purchase 1 Acre Site		LS		50
5 Tanks	180K	gal	1.00	180
Site Prep		LS		40
Berms	3,000	CY	40	120
Gravel & Insul.	1,000	CY	40	40
6" Dense Insul.	200	SY	150	30
Piping/Valves/Controls		LS		200
Transfer Stations		LS		200
				$1,105
New Equipment for Cape Blossom:				
50 Ton Crane	1	EA		$ 500
30 Ton Forklift	1	EA		225
15 Tom Forklift	1	EA		90
Snow Removal Truck, Equip.	1	EA		180
				$ 995

PHASE II

	Quantity	Unit	Unit Cost	Total Cost (Thousands)
15 Ton Forklift	1	EA		$ 90
30 Ton Forklift	1	EA		225
Fire Truck, Foam & H_2O	1	EA		200
				$ 515

AIRPORT FACILITY

5.0 AIRPORT PLAN

The possibility of developing an airport near Cape Blossom is predicated on two possible needs. The first is a future need to relocate all present airport functions to Cape Blossom to improve aviation operations and access to the south. The second is to provide a facility for heavy transport aircraft, such as the Hercules, to fly in derricks and critical supplies in support of outer continental shelf oil operations; for these operations, airport proximity to the new port and avoidance of truck traffic through the city may be desirable. This discussion focuses on utilizing a Cape Blossom airport for "industrial" purposes.

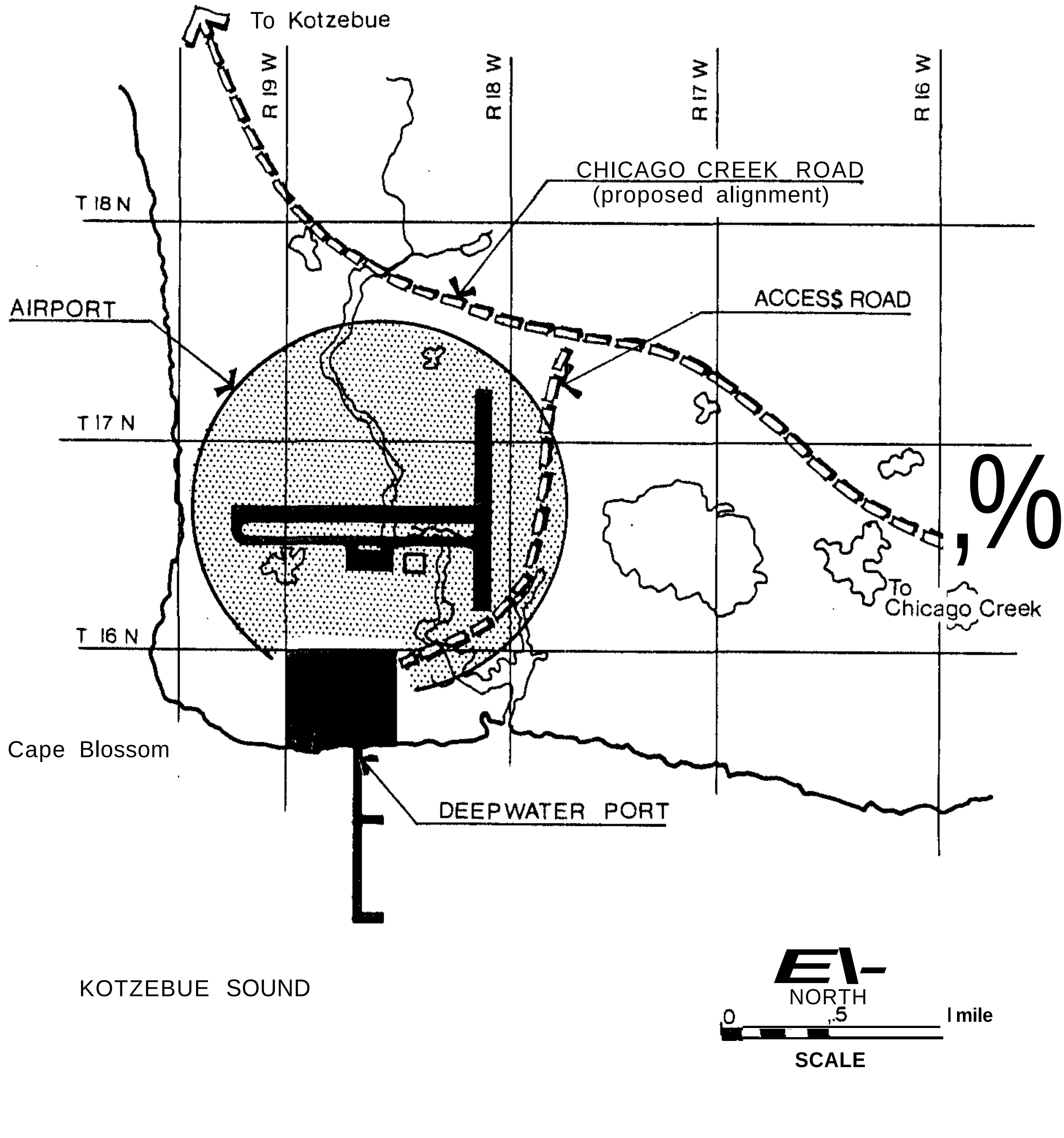
The basic configuration envisioned for the Cape Blossom industrial airport consists of a 6,400 foot runway oriented east-west, with a parallel taxiway: a parking apron would be centered along the runway. The location of the proposed airport and its relationship to other Cape Blossom port facilities are shown on Figure C-5.1. The operations building and lease lots would be located on a parcel bordering the apron. The parking and storage area would be located adjacent to the terminal building. A crosswind runway, oriented north-south, while not part of the present proposal, would be positioned to achieve the appropriate clearances.

5.1 RUNWAY REQUIREMENTS

The airport at Cape Blossom would be classified as a "general transport airport". A general transport airport is defined as one that accommodates transport category aircraft used in general aviation and weighing less than 150,000 pounds. "General aviation" is defined as all civil flying not

PROPOSED AIRPORT LOCATION

FIGURE C-5.1



classified as "air carrier" (that which serves scheduled airlines). It thereby encompasses many different categories and types of aircraft. General aviation includes activities such as personal flying, transportation of personnel and air taxi service. The gross weight for larger aircraft commonly used in the area does not generally exceed 150,000 pounds. For example, the maximum takeoff weight for a Boeing 737-200 and a Lockheed Hercules (C-130) are 115,500 pounds and 155,000 pounds, respectively.

Future operational demand may be sufficient to justify a precision instrument runway (PIR) designation, and it is therefore appropriate to provide for PIR operations from the outset.

Airport design criteria used in determining the need for a 6,400 foot runway and parallel taxiway are contained in Appendix E.

Projected traffic is such that parallel runways do not appear to be necessary now or in the foreseeable future. However, the land required for a possible future parallel taxiway should be acquired, particularly if there is any perceived possibility of relocating present air carrier and general aviation activities. Additionally, while there is no firm basis for projecting demand for air carrier service at the new airport, it would be wise to acquire sufficient land to accommodate landside needs of such future expansion before the available land is developed for other purposes. Measures should also be taken to assure future environmental and airspace compatibility with air carrier operations. As this general transport airport could ultimately be used to service large jet freighters, sufficient space should be provided to accommodate expansion.

5.2 SUPPORT FACILITIES

Airport Buildings

The airport at Cape Blossom would be equipped with a combination operations, administration and storage building, and maintenance shed. The operations structure can be a 60 foot by 40 foot modular metal structure with an office, meeting area, space for Ereight storage, operations areas, and a waiting area. The maintenance structure should have similar dimensions and be located adjacent to the terminal building. Space allocation adjacent to the terminal should include provision of approximately 3 acres for leasing for aviation and non-aviation related purposes. The total airport building site should cover about 4 acres, with no provision for possible future passenger terminal facilities.

Access and Storage

Access roads must be provided to interconnect the port, airport, and Kotzebue and to connect facilities located on the airport premises. The major space requirement will be for parking and storage. The parking area can be reasonably expected to store a combination of 30 passenger type vehicles and 30 pieces of heavy equipment. To determine total space needed, an average space requirement of 400 square feet per vehicle and 1,000 square feet per piece of heavy equipment was used. The basic parking area was then increased approximately 20 percent to allow for maneuvering, snow storage, and a fuel facility.

An additional acre would be required to handle break-bulk and other material storage. Approximately 3 acres would accommodate the access and storage needs of Cape Blossom airport.

The present Kotzebue airport is substandard in certain respects, particularly runway safety width and runway smoothness. The opportunity exists to combine general air transport and air carrier operations near Cape Blossom generally within the above framework, if it is decided to abandon the present airport.

1.0 SOCIO-ECONOMIC IMPACTS

Potential economic impacts will center in three basic areas: employment; business activity; and public revenues and costs. Economic impacts associated with the proposed project will include direct economic impacts during construction, permanent effects from project operation, and secondary economic impacts resulting from induced population growth and business activity. It is anticipated that construction related socio-economic effects will be very different from subsequent effects of project operation.

1.1 CONSTRUCTION IMPACTS

Construction of the proposed project is estimated to require two to three years to complete, based on an average construction work period of nine months per year. However, actual construction time required to complete the project is approximately two years if a year round construction work period becomes viable. The principal construction marshalling and staging area is anticipated to require approximately one to two acres, and would be located at the proposed port facility site.

Direct. Construction Costs

Total direct construction costs for the proposed project are estimated at approximately $86.3 million. Total materials and equipment cost is assumed to average 70 percent of the total direct construction costs, with labor averaging 30 percent. The development is proposed in phases. Costs are approximately as follows:

I: $34,861,000
II: 51,458,000
Total: $86,319,000

Additionally, on-shore development costs which depend on the level of economic development are estimated to total $14,932,100.

Direct Construction Employment

Construction employment for the proposed project would be expected to require a range of 100 to a peak of 150 employees for two to three construction work seasons, if all phases are completed in a continuous program. Although the construction time phases for onshore and offshore work do not coincide exactly, the construction work force is expected to average approximately 125 workers during project construction, under a full construction scenario.

Construction of the project will involve various types of skilled and unskilled labor. A summary of manpower requirements by skill type, construction component, and availablity are presented in Table D-1.1. Of the average construction manpower requirements, an estimated 75 to 112 workers, or 75 percent of the peak labor requirements, are expected to be obtained from the local labor market. An estimated 25 to 38 workers, or 25 percent of the peak, are expected to be imported from outside the project region.

Construction manpower requirements, although relatively temporary in nature, will have a significant impact on local employment in Kotzebue. Project construction employment will have a beneficial effect on the current unemployment rate. Although there is a potential shortage of certain skilled labor types, there is currently a local surplus of many semi-skilled and unskilled labor types which could be utilized in project construction.

MANPOWER BY SKILL TYPE

TABLE D-1.1

Construction Activity	Manpower Imported Labor	Requirement Local Labor
Management	Project Manager Assistant Manager Foreman	Truck Drivers Tug Crew Barge Crew
Causeway Work	Surveyors Crane Operators Maintenance Crew	Bulldzr. Drivers Loader Driver Canteen Staff
Quarry Work	Foreman Drillers Loaders Drivers	
Shore Work	Foreman tirader Drivers	Carpenters Brick Layers Plumbers Laborers
Concrete Work	Batcher Operator Crusher Operator Steel Fixes Concrete Foreman	Batch Plant Laborers Crusher Labor Concrete Crew

Construction Materials Requirements

Total construction material costs are estimated at approximately $60 million, or 70 percent of total project construction costs. Of the total construction material requirements, an estimated 80 percent, or approximately $48 million, will be purchased locally. Construction materials expected to be purchased locally include concrete, sand, gravel, diesel fuel, gasoline, and lubricating oil. In addition, an estimated 20 percent of total construction material requirements, or approximatel.y $17 million, will be imported from outside the region including cement, steel, and heavy construction equipment.

The purchased fill material is expected to have a significant local impact with respect to local area suppliers, although no significant adverse long term impacts on local supplies are expected. Potential short term adverse impacts on local petroleum supplies could result from construction of the proposed project. However, accurate projection of petroleum supplies required during each construction work season and coordination of local and regional supplies could reduce potential adverse impacts on local and regional needs. To the extent that construction fuel demands cannot be coordinated with local supplies and delivery schedules, the contractor could provide additional on-site fuel storage to minimize any adverse impacts on local supplies and storage capacity.

Secondary Employment Generated by Construction

Potential secondary employment generatea locally a5 a result of project construction should be relatively significant given the short construction work phases and relatively small size of tne average construction work force. Secondary employment is likely to be generated from two distinct construction activities: construction payroll spent locally and construction materials purchased locally. A total employment effect of approximately 275 to 325 short term direct and secondary jobs would potentially result from the proposed project, if fully developed over three years.

1.2 OPERATION AND MAINTENACE IMPACTS

Commercial/Industrial Impacts

Numerous potential direct and indirect economic benefits are anticipated from improved port facility economic activities, including port-related wholesale and retail trade activity, existing port-related supplies, and development of new port-related service activities, including potential mineral resources and fishing activities. The most probable mineral aevelopments involve the Chicago Creek coal fields and OCS oil exploration and development activities. With an adequate port facility, the City of Kotzebue could act as a principal support and construction staging area with potentially significant long term economic benefits to the City.

Direct Permanent Employment

Operations and maintenance of the proposed port project are not expected to have an immediate impact on employment in Kotzebue, assuming that most of the current port operations and related employment is transferred over to the new facility. The proposed project will require approximately $700,000 per year For operations and maintenance.

Costs associated with port operations include salaries and fringe benefits, equipment maintenance, utilities, and debt servicing. It is assumed that four part time employees would be used during the summer shipping season for cargo transfer between barges and the onshore storage areas. Three full time permanent employees were assumed to provide year-round security and administration.

The equipment needed to serve the new port is described in Part B, Section 3 of this report. Maintenance of the port facilities would include average annual costs for ice and storm damage to the causeway and pier facilities, plus repair and replacement costs of buildings, storage areas, road surfaces, and utility facilities. Table D-1.2 displays expected annual operations and maintenance costs.

2.0 ECONOMIC DEVELOPMENT ASPECTS

2.1 FACILITY FINANCING

The government role in port and harbor development has traditionally been substantial in Alaska. The development of adequate harbor facilities as a part of the State's marine highway transportation system has conventionally been a function of the state. Federal and state governments were consequently viewed by municipal governments as potential funding sources for harbor planning and development. However, many federal agencies and some state agencies are sometimes viewed as impeding local harbor planning ana devlopment, and as providing inequitable support for existing and competing regional harbor facilities. Port powers are delegated by the state to local agencies.

The high capital investment costs involved in harbor development, a relatively limited user season, as well as extensive harbor benefits which accrue outside the local

ESTIMATED ANNUALIZED PORT OPERATIONS AND MAINTENANCE COSTS* TABLE D-1.2

Activity	Estimated Cost (1982 dollars)
Operations	
Salaries	
Full Time Employees	$135,000
Part Time Employees	32,000
	$167,000
Equipment	
Forklifts	$ 30,000
Tractor Trailers	60,000
Dockside Crane	25,000
	$115,000
Utilities/Insurance Contingencies	75,000
TOTAL OPERATIONS COST:	$357,000
Maintenance	
Buildings	$ 10,000
Storage Yard	10,000
Roads	25,000
Piers	75,000
Causeway	75,000
Utilities	50,000
Dredging	100,000
TOTAL MAINTENANCE COST:	$345,000
TOTAL OPERATIONS & MAINTENANCE COST:	$702,000

* - Assumes total project completion, Phases I and II.

area, however, dictate the necessity for federal and state assistance in developing adequate local marine facilities. The federal government is often heavily involved in the initial site evaluation and selection, environmental permit certification, and with developing and maintaining breakwaters, turning basins, channels, and entrances. The state and local governments are usually involved early in the development process with the actual design layout of the slips and other facilities within the harbor.

Significant federal and state grant and loan funds are available to finance port and harbor improvements. There are four major sources of state and federal financial assistance for port and harbor developments: the U.S. Army Corps of Engineers, the U.S. Economic Development Administration, the U.S. Coastal Energy Impact Program, and the Alaska Division of Harbor Design and Construction. Each is discussed below:

The U.S. Army Corps of Engineers. The Corps provides funds only for the construction of breakwaters, entrance channels, and maneuvering areas. There are two project classifications. Large projects require special Congressional authorization for study and funding. Smaller projects, also known as Section 107 projects, can be undertaken by the Corps without special authorization. However, the total participation of the Corps in these projects is limited by law to $2 million.

The U.S. Economic Development Administration. The Economic Development Administration (EDA), an agency of the U.S. Department of Commerce, provides grants and loans to assist in the construction of public facilities (including port facilities) that are needed to stimulate long term business and economic development. A project must be specifically linked to the creation or saving of long-term permanent jobs. EDA's program has two parts: public facility grants, which are made to local governments only; and a business loan program, which provides loan guarantees for up to 50 percent of the cost of private projects.

The availability of funds is currently unknown. However, the public facility grant and loan program is expected to continue. EDA has funded several port projects in Alaska, including the Ketchikan Dock, the Heidelberg Industrial Area, and the Dillingham Dock.

Coastal Energy Impact Program. The Coastal Energy Impact Program (CEIP) is a Coastal Zone Management Act program designed to mitigate the impact of Outer Continental Shelf (OSC) oil and gas exploration ana production. ‘Three different types of financial assistance are available to State and local governments: planning grants, formula grants, and credit assistance. The Alaska CEIP office has made a policy decision to use formula grants for planning design only. CEIP credit assistance for construction is available through the Alaska Municipal Bond Bank Authority.

Available funds are allocated to eligible projects within Alaska on the basis of an administation code which takes into consideration such factors as the imminence of actual energy impact, the type and magnitude of impact, the appropriateness and administrative capabilities of the entity applying for the funds, and the degree of tax effort made by the entity. With proposed Federal cuts focused toward balancing the budget, the entire CEIP program has been considered €or elimination.

Division of Harbor Design and Construction

The DHDC, a division of the Alaska Department of Transportation and Public Facilities, is responsible for providing port-related facilities throughout Alaska's coastal areas.' DHDC utilizes funds received from three basic sources:
supplemental capital improvement budget from oil and gas royalties; regular budget for the water craft fuel tax; and general obligation budget funds repaid from the General Fund.

The State Legislature may authorize sale of bonds to finance transportation facilities, a percentage of which is set a-side for municipal port and harbor development. Most authorization laws have a 10 percent local funds requirement. Municipalities desiring new facilities or improvement have two choices: 1) they can request the State Division of Harbor Design and Construction to engineer and build the facility, or 2) the municipality can receive the money as a grant and contract the work themselves. In either case, the facility is usually administered by the municipality.

Once a complete facility has been constructed from federal and state tax monies, the facility is usually leased at no cost to a local government. This means that, traditionally, public ports and harbors are owned by the state, but administered by local governments (University of Alaska, 1951). In order to maximize public administrative effectiveness and economic efficiency associated with private enterprise, the following policy considerations are recommended:

- The construction of the port should be financed by the state.

- o Administration of the port should be accomplished by a local municipality agency.

- o Operation of tne port should be contracted on a lease bid basis to a private operator.

Information regarding the use of Industrial Development Bonds for funding the project may be found in Appendix G.

2.2 PORT REVENUES

Revenues derived from port user fees, in the form of a terminal tariff, were forecasted by applying an assumed tariff rate structure to projections of cargo throughput tonnages. Terminal tariffs normally consist of time-based and weight-based charges for dockage, wharfage, handling, freight storage, and labor and equipment services. Typically, these charges are set to provide sufficient revenue for operation and maintenance costs, debt service, and income for capital improvement projects. It is unlikely that tne proposed port could generate the revenues required for recovery of total development capital, unless significant mineral export development occurs.

The method used in projecting revenue potential was based on rate structures of the present lighterage tariff at Kotzebue. Wharfage and handling charges for dry cargo are estimated at $60.00 per ton. Table D-2.1 summarizes the most-likely level and the highest level of throughput and estimated port wharfage and handling revenues, based on current lighterage charges at Kotzebue. In the event that concentrated mineral development and oil and gas development and production were to materialize in the region, the expected throughput and projected revenues would increase substantially. Cargo throughput yuantities taken from Tables B-4.4 and 4.5, Part B of this report.

Additional port revenues could be derived from use-fees for dockage, storage, labor and equipment, and lease space. Revenues from such fees are difficult to accurately estimate at this time. However, any potential operating, maintenance, or contingency fund deficits could be budgeted from various types of user fees, These include:

- Docking of workboats related to petroleum exploration, development, and production, primarily for the purpose of securing provisions and supplies, and transporting work crews and equipment;

- Docking of fishing vessels operating in Norton Sound and nearby fisheries, primarily for the purpose of securing provisions and supplies;

- Docking of vessels for the purpose of receiving minerals mined in northwest Alaska for transport to Japan or the "lower 48";

- Docking of vessels and transshipment of cargo related to petroleum development activities on the Beaufort and Chukchi Seas: and

- Leasing of land within the port complex to private firms for the purpose of construction and utilizing operations and storage buildings, fuel facilities, repair facilities, and similar structures, as well as for open land for container storage and other types of storage.

PROJECTIONS OF POTENTIAL PORT REVENUE *

TABLE D-2.1

Study Year	Potential Waterborne Most Likely Case (tons)			Dry/Liquid Cargo High Growth Case (tons)			Projected Wharfage and Handling Fees ($ millions)	
	Inbound	Outbound	Total	Inbound	Outbound	Total	Most Likely	High
1985	30,985	10,695	41,680	32,550	11,235	43,785	$1.40	$1.52
1990	40,997	13,017	54,014	45,246	14,366	59,612	$1.81	$2.00
1995	42,623	15,594	58,217	49,417	18,079	67,496	$1.96	$2.27
2000	38,849	15,808	54,657	47,319	18,037	65,356	$1.84	$2.20

Notes:

* Assumes mnstant per ton lighterage charges of $27 per ton liquid bulk and $60 per ton dry cargo lighterage at Kotzebue.

2.3 COST SAVINGS

In addition to revenues generated from wharfage and handling fees, any development proposed that reduced or eliminated lighterage would also produce further cost savings benefits through reduced time at anchorage by ocean-going barges. These vessels have an estimated value of approximately $14,000 per day at anchor. During 1980 the ocean-going barges were at anchor 26 barge-days (WATTS, 1981). Assuming a reduction in ocean barge time at anchor by 50 percent, the proposed port development would generate further cost saving benefits.

The potential ocean barge time savings would be $125,000 annually, which amounts to approximately $7.00 per ton of cargo arriving in 1980. This amount applied to the projected 1990 tonnage indicates a potential annual cost-savings benefit of $300,000 based on the most-likely case. Assuming this cost-savings benefit were capitalized at 8 percent over 50 years, the indicated savings would justify an investment of $3.7 million.

It is useful to consider what capital investment can be Justified in order to realize the estimated annual direct port revenues less operation and maintenance costs. Estimated capital investments which can be justified, assuming the revenue benefits were capitalized at 8 percent over 50 years, are presented in Table D-2.2 for the most-likely and high-growth cases for the study year 1985.

Indicated capital savings would justify a minimum investment of about $9 million. If consideration were given to capital value of reduced anchor time, then total capital savings would justify a $12.7 million investment based on the 1985 most likely case net-revenue estimate.

Another consideration relative to cost savings is made by comparing the existing lighterage costs for fuel to the future costs of truck hauls from Cape Blossom. The apparent lighterage costs are $27/ton for liquid bulk. The estimated truck haul costs are about one-third that amount ($10/ton). Conversely, a pipeline from Cape Blossom is estimated to have annual costs of $1 million, which equates to approximately $40/ton at existing throughput levels.

2.4 ECONOMIC CONCLUSIONS

It is anticipated that the annual cost of total debt service and operation and maintenance activity at the Port of Xotzebue will exceed the total income generated by the Port. This conclusion is somewhat speculative, because of the uncertainty in forecasting the extent and magnitude of developments in petroleum, mining, and coal industries. It does seem clear, however, that revenue generated from port operations will exceed the cost of port operations and maintenance. Given the rather conservative port revenue scenario that anticipates income from projected population growth and existing Kotzebue port fee rates, the revenue would justify n local investment of about $13 million, If other more optimistic growth levels develop or the tariffs use fees were increased, then port revenues as well as the level of capital investment would increase accordingly.

POTENTIAL CAPITAL INVESTMENT BENEFITS (In $ Millions)

TABLE D-2.2

Study Year	Capital Investment Benefit	
	Most Likely	High
1985	$8.6	$10.0

STUDY CONCLUSIONS AND RECOMMENDATIONS

1.0 PORT FEASIBILITY

1.1 SITING

After identification of several potential port sites, three candidate sites were selected for investigation in this study, the existing City Dock site, the Cape Blossom site, and the Isthmus site. The Cape Blossom site shows distinct advantages, including proximity to deep water (4,000 feet, versus 6,000 feet for the Isthmus site and 13 miles for the City site), coupled with reasonable proximity to the City of Kotzebue. Because of access to deep water at Cape Blossom, off-shore construction costs are the lowest of the three sites. The City location is not feasible for construction of a causeway to a berthing facility, and dredging a channel would be prohibitive both on a first-cost and maintenance basis. Adjacent upland areas at Cape Blossom have a high degree of suitability for development, compared to the City site, where very little land is available, and the Isthmus site, where high bluffs and high erosion potential exist. Onshore development costs at Cape Blossom are therefore less.

Other advantages of the Cape Blossom site are: perceived minimal effects of development on bird or mammal habitat and fish migration; minimal susceptibility to soil erosion; and compatibility of port development with adjacent land uses. Additionally, suitable land for eventual development of an adjacent auxiliary airport is available.

Cape Blossom is recommended as the site of the proposed new Kotzebue deepwater port. Further, it is recommended that acquisition of land for an adjacent airport occurs simultaneously with acquisition of land for the port facility, to insure its availability when and if needed.

It is also recommended that the existing City Dock in Kotzebue be utilized as a transshipment facility for service to the hinterlands, and that the existing Chevron tankfarm be relocated to a new, safer location at Cape Blossom. Trucking of fuel and transshipment goods appears feasible, although development of POL pipelines from the Cape Blossom storage tanks to town is recommended. Kivalina, north of Kotzebue Sound, is projected as a site for a major mining export location. This location is too remote from Kotzebue to improve the economics of lightering fuels and general cargo. Public finance opportunities for development of this facility are discussed in the main report.

1.2 DEVELOPMENT PLAN

The recommended plan for development of the deepwater port at Cape Blossom provides for phased development keyed to increased shipping demand. Phase I development would include construction of an 1,800 foot earth-fill causeway to a berthing facility in 18 feet of water. One portion of the causeway would be structural, providing an elevated span over open water to facilitate near-shore fish migration. This structural span would be constructed of pre-cast decked bulb tees; the earth fill causeway would be constructed of suitable core material and armor rock to resist wave and ice forces. The berthing facility would be constructed of earth-filled concrete caissons.

This Phase I development would provide adequate berthing depth to serve most vessels now calling at Kotzebue. By the time they reach Kotzebue, most deeper draft barges have unloaded cargo at other ports and would be able to moor at the pier.

Additional Phase I development would include pipelines on this causeway to offload liquids to a tankfarm on shore. Other on-shore development in addition to the tankfarm would include a 12,000 square foot warehouse and outside storage areas for weather-proof bulk caryo, containers, staging areas, OCS support areas and ore stockpile areas, Initially, port administrative offices would remain at Kotzebue, until such time as shipping at the new port increases because of coal and ore mining activities or OCS oil exploration and development activities.

Some minimal utility service will be needed at Cape Blossom, as electrical power, water, and sanitary sewer services cannot be reasonably extended from the City of Kotzebue. An access road must be built from the port site to the planned Kotzebue - Cape Blossom road. security fencing would be provided as appropriate.

Phase II

At such time as shipping increases due to increased mining or Chukchi Sea OCS oil exploration and development, Phase II development of the port would occur. Phase II development calls for extension of the fill causeway to the minus 25 foot water level, which is 4,000 feet offshore. This would require a 2,200 foot extension of the Phase I causeway. A second L-head pier of concrete caisson construction would be built at the end of the causeway. It may be desirable to build a structural rather than fill causeway, if adequate armor stone is not available, or if the environmental impacts of an extended fill causeway are deemed to be unacceptable. If a structural causeway were built, it should utilize precast decked bulb tees supported by concrete box-based monopods.

The berthing area, maneuvering basin and approach channel would be dredged to the 30 foot depth to allow vessels of up to 28 feet of draft to moor at the outer pier. The fuel pipelines would be extended to the new pier.

A conveyor system would be provided to load bulk carriers from on-shore coal and ore stockpiles. Additional on-shore development during Phase I would provide buildings for additional storage, facilities mainatenance, and port administration and security. Utility systems would be expanded and would probably include tertiary sewage treatment.

As Phase II development proceeds, port operations would be transferred from the existing City Dock to Cape Blossom. Eventually, only a small transshipment function would remain at Kotzebue, which would free the existing land and buildings for other uses,

It is emphasized that this two-phase approach to deepwater port development has been designed to serve two purposes:

1. To provide an economically feasible way to meet Kotzebue's present shipping requirements and eliminate costly and tine-consuming lightering of cargo,

2. To provide for additional port development as it is needed to support increased mining and oil development in the region.

1.3 ECONOMICS

The total cost of the first phase of port development is estimated at $34.5 million. Phase II development is estimated to cost an additional $57.8 million. Total on-shore development costs are estimated at $14.9 million. Total project costs are therefore $107.2 million.

Balanced against these costs are the benefits that would accrue. These include short term benefits that would be realized during project construction, and long term benefits that would continue throughout the life of the new port.

The project construction period would last for two to three construction work seasons, if both phases were completed in a continuous program. In all likelihood, some period of time would elapse between construction of Phases I and II, so the short term construction employment benefit may actually be spread over several more years, with some periods of relative inactivity. It is estimated that the total construction work force would average about 125 workers under a full construction scenario; about 75 percent or a total of 93 of these jobs would be filled from the local labor market. A partial listing of those that would likely be filled from the local labor force includes truck drivers, bulldozer operators, loader operators, tug and barge crew members, canteen staff, carpenters, brick layers, plumbers, laborers, batch plan operators, concrete crewmen and concrete and crusher laborers. There is currently a surplus of many of these labor types in the Kotzebue area.

It is estimated that about 30 percent of the total project cost is in the labor component. This means that the total local direct labor benefit during construction would be approximately $24 million.

Construction materials costs are estimated at 70 percent of total project costs: of this total, 80 percent will be locally purchased materials. This would mean that approximately $60 million worth of concrete, sand, gravel, diesel fuel, gasoline, and lubricating oil will be purchased locally.

In addition to these direct benefits to the local job force and to local suppliers, secondary local employment will also be created. Secondary employment is likely to be generated from two distinct construction activiteis: construction payroll spent locally and construction materials purchased locally. A total employment effect of about 275 to 325 short term direct and secondary jobs would be expected during the construction period.

Long term direct and indirect economic benefits would also result from completion of the project. These fall into two general categories: those resulting from enhanced port activities and related services and those resulting from direct and secondary permanent employment.

In the first category, numerous direct and indirect economic benefits are anticipated from improved port facility economic activities, including port-related wholesale and retail trade activity, existing port-related supplies, and development of new port-related service activities, including potential mineral resources and fishing activity. The most probable mineral developments involve the Chicago Creek coal fields and Chukchi Sea OCS oil exploration and development activities. With an adequate deep-draft port, the City of Kotzebue would act as the principal support and construction staging area for these activities, with very significant long term economic benefits to the city.

Chukchi Sea offshore leases are scheduled for February 1985. This area is considered to be of high interest and could be compared with the recent $2.1 billion Harrison Bay sale. Kotzebue is the closest port with a reasonable ice-free season, and provides air support capability. As such, considerable OCS support activities could be expected through the proposed new Cape Blossom port. Should Chukchi Basin/Hope Basin development be successful, it is very likely, in the opinion of this consultant, that transport of oil will be most economical via pipeline to the Kotzebue area and thence by ice-reinforced tankers to Uniat Pass (Aleutian/Alaska Peninsula) with transfer to conventional tankers at that point. Economics and environmental constraints do not favor pipelines east of TAPS.

Such an activity could occur at Cape Blossom, and would justify major expansion of backlands areas for tank storage for the ice-bound winter months.

In the second category, a smaller but still significant benefit is realized from permanent direct and secondary employment associated with operating and maintaining the new port. The estimated operations and maintenance budget for the new port is $700,000 per year, with three full-time and four part-time employees required on a permanent basis.

The economic feasibility of the proposed new port at Cape Blossom is dependent on two factors: 1) the benefits, values and revenues generated by this new port, compared to its costs, and 2) the financing of the facility.

Direct revenues generated from any port would normally consist of time-based and weight-based charges for dockages, wharfage, handling, freight storage, and labor and equipment services. Typically, these charges are set to provide sufficient revenue for operation and maintenance costs, debt service, and income for capital improvement projects. It is unlikely that the proposed port could generate the direct revenues required for recover of total development capital, unless significant mineral or offshore oil export development occurs. Nevertheless, Kotzebue has been identified as a hub port in Alaska, and social needs will be well served by such a facility.

The annual cost of total debt service and operation and maintenance activity at the new port appear to exceed the total income generated by the port.

New port development costs are always very high. For this reason, and because port development does result in substantial benefits accruing both in and outside the local area, federal and state assistance is usually provided in developing local marine facilities. Available forms of assistance provided are substantial and varied and are discussed in Part D, Section 2.

Assuming that the state and federal assistance is provided, it is highly desirable to proceed with development of the new deepwater port at Cape Blossom. The phased approach to development presented in this study should be followed to insure that the pace of port development follows the rate of increase in shipping demands, without unjustified early investment.

2.0 AIRPORT FEASIBILITY

2.1 SITING

As part of the process of examining potential port sites, the feasibility of locating an adjacent auxiliary airport was studied. As with deepwater port development, the Cape Blossom site has clear advantages for airport development. Adequate level land is available for both a main, east-west runway and a cross-wind runway. Approach clearances are excellent, and land is available for development of terminal facilities, airplane parking, and cargo handling. The Isthmus site also has suitable land available adjacent to a potential port site, but approach clearances are less suitable and the site is remote from town. The existing airport in Kotzebue, while adequate for present passenger and cargo service, has very limited land available for expansion. If major air support is needed to support OCS or other development, an auxiliary airport at Cape Blossom is physically feasible.

2.2 DEVELOPMENT PLAN

The possibility of developing an airport adjacent to the Cape Blossom deepwater port is predicated on two possible needs. The first is a future need to relocate all present airport functions to Cape Blossom to improve air operations and access to the South. The second is to provide a facility for heavy transport aircraft, such as the Hercules C-130, to fly in derricks and critical supplies in support of outer continental shelf oil operations. For these operations, proximity if the airport and deepwater port and the avoidance of truck traffic through the City may be desirable. The function of such a facility is most likely to be as an auxiliary industrial airport with passenger and air cargo service continuing at the present facility.

If it is determined that an auxiliary airport is needed, the Cape Blossom site should be developed as a "general transport" airport, one that accommodates transport category aircraft used in general aviation and weighing less than 150,000 pounds. Passenger operation would be retained at the existing airport, as it is more conveniently located for such service. The new airport would be an industrial type cargo airport.

The auxiliary airport would be located just north of the deepwater port at Cape Blossom. The basic configuration consists of a 6,400 foot runway oriented east-west, with a parallel taxiway; a parking apron would be centered along the runway, and an operations buildings and lease lots would be located adjacent to the operations buildings. A cross-wind runway, oriented north-south, is not part of this proposal, but provision for its eventual inclusion in the airpor design has been made. Traffic projections indicate that parallel runways do not appear necessary. However, the land required for possible future parallel taxiway should be acquired, particularly if there is any perceived possibility of relocating present air carrier and general aviation activities to the new airport. Similarly, while there is no firm basis for projecting demand for air carrier service at the new airport, it would be wise to acquire sufficient land to also accommodate landside needs of such future expansion. As the general transport airport at Cape Blossom could ultimately be used to service large jet freighters, sufficient space should also be provided to accommodate runway extension.

2.3 ECONOMICS

A very preliminary cost estimate of $20 million was made for a new airport at Cape Blossom. Specific studies of the costs associated with creation of an auxiliary airport at Cape Blosson would range from $7-10 million. Detailed studies should be completed if the OCS oil exploration and development activities materialize, or if it is determined that all airport operations are better handled by relocating them to a new airport at Cape Blossom.

APPENDIX A
PUBLIC INVOLVEMENT

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APPENDIX B
FIELD STUDY NEEDS

APPENDIX B

Geotechnical Exploration

The geotechnical. program is designed to identify conditions on and offshore such that appropriate design criteria can be developed. Also, potential material sources will also be studied to determine their extent and quality. Some modifications of this program may be required if conditions encountered during the investigation are greatly at variance with published data on the area.

The cost estimate is based on drilling 22 test holes to an approximate depth of 30 feet in the soil. The drilling would be accomplished during the winter with the drill rig operating 24 hours per day in two 12-hour shifts using a crew of one driller, one helper, and three geologists/ engineers. The crew would probably overnight at Kotzebue. Transportation to and from the site would be by ice equipped aircraft or snow machine type vehicle as reyuired. The drill and associated equipment would be mobilized out of Anchorage. The drill would be mounted on a Vodwell type track vehicle and 70 feet of hollow stem auger and 70' of casing will be required. Project duration is estimated to be 15 days based on an assumed rate of 1.5 test holes per day. A contingency of 20 percent is added to account for weather days and other unforeseen conditions. The geotechnical investigation will cost approximately $200,000, as shown on the following cost estimate. A detailed breakdown of the exploration program follows the cost estimate.

COST ESTIMATE

ITEM	COST
Drilling mobilization and demobilization	$ 8,000
Drilling and crew, 15 days @ $3,528/day	52,920
Charter of Hercules aircraft Anchorage to Kotzebue; deliver drill rig & equip. to Kotzebue airport (guarantee start-up date)	16,663
Return drill rig & equipment via scheduled Herc service	8,575
Room & Board in Kotzebue @$150/day/man for 7 person crew for 17 days	17,850
Technical crew (geologists/engineers) cost $55/hr./person; 12 hrs/day x 3 people X 17 days	33,660
Round trip tickets on commercial airline for crew (7 people)	2,800
Transportation to/from drill rig while in field 17 days - aircraft @$300/day; snow vehicle @$100/day	6,800
Laboratory testing and report	25,000
SUB TOTAL	$172,268
Contingency @ 1.15%	25,840
TOTAL	$198,108

Table B-1 - Proposed Soils Exploration Program
Total 22 test holes

Number of Holes	Facility	Depth	Method	Purpose
13	Breakwater	30' (into soil)	Size H casing w/casing advances where water is available. Hollow stem auger if water not available (probably near shore). Sample every 5 feet.	Define sub-surface/sub-sea soil conditions along center-line of breakwater. Nature of permafrost to unfrozen transition near share (?).
3	Airport Runway	30'	Continuous sampling/drilling w/modified Shelby sampler.	Define sub-surface soil conditions. One hole to define conditions at river crossing - drill in mid channel.
1	Airport Terminal	30'	as above	Define sub-surface soil conditions
1	Seaport	30'	as above	Define sub-surface soil conditions.
2	Potable Water Source	30'	Start w/modified Shelby. Switch to hollow stem auger or casing w/ advances if unfrozen material encountered. Sample only at strata change.	Possible potable water source. Explore depth of water; determine if thawbulb is present; nature of soils (potential aquifer ?) under River/Lake.
2	Material site	30' (minimum) 60' (if granular soils encountered)	Onshore: Hollow stem auger in granular materials. Drive sample every 5'.	Possible sand/gravel material site.
		30' (into soil)	Offshore: use "breakwater" method.	Possible sand/gravel material site.

OCEANOGRAPHIC STUDIES

To assure a cost effective and structurally sound final harbor design, the following field studies are recommended for the chosen site.

a). Testing yearly ice to determine forces that will be acting on the structure. Ice tests recommended are salinity, thickness, temperatures, along with direction and rate of movement during breakup and while grounded.

b). Detailed bathymetric survey to determine best orientation and exact location of the harbor in the general area of the site.

c). Wave gauges should be placed to determine height and possibly direction of waves approaching the site. This should include periods of peak storm activity if possible. Wave data helps define the littoral climate and determines design wave conditions.

d). A tide gauge at the site is strongly advised. Knowledge of the tidal range is one of the main design criteria. Tides at Kotzebue were measured in 1950 and found to have an average range of 1.1 feet. The closest station where tide predictions are made is Kiwalik where the mean diurnal range is *2.1* feet. Since the site is between these two locations, the tide could range from one foot to over two feet.

e). A current meter should be deployed offshore from the site location. Strong currents could have a definite impact on the port design and use.

A very approximate cost has been calculated for the above recommended testing procedures. If wave gauges and current meters are deployed at the time of the bathymetric survey, the least cost to the project would result. When wave gauges are used, a tide gauge is not necessary because tidal ranges can be calculated from the wave data. The cost of these recommended studies, including bathymetric survey, deployment and retrieval of instruments, and data analyses (recommendations "E" throught "E") would be approximatelu sixty-five thousand dollars ($65,000). If wave direction was to be determined, an additional thirty thousand dollars ($30,000) would be necessary. If the above recommendations were to be carried out independently, the cost would be higher.

The ice testing cost would depend on the length of time over which the ice movement is measured. For two months of monitoring ice movement, along with salinity, temperature and thickness tests, the cost would be approximately thirty thousand dollars ($30,000). If only salinity, temperature, and thickness tests are performed, the cost would be approximately ten thousand dollars ($10,000).

APPENDIX C

SITING COST ESTIMATE

APPENDIX C

PRELIMINARY COSTS

Background

In this appendix, a very preliminary cost estimate is developed for constructing a port, airport, and associated facilities at Cape Blossom. Construction costs from several previous jobs in the area have been compiled and analyzed in terms of the requirements of this project. Offshore work introduces elements of uncertainty into a project, and the potential difficulty of obtaining materials further complicates the issue. However, it is possible to provide fairly reliable but conservative overall cost estimates for this type of project.

The design criteria have been selected to satisfy present and projected needs. They may be modified in order to reduce costs. Furthermore, the project team will continue to investigate alternative construction procedures and other means to reduce costs while continuing to meet performance objective.

Fill Material Sources

During our mid-June field reconnaissance, two engineers on the project team participated in an overflight of Baldwin Peninsula and south Kotzebue Sound to Deering in order to visually identify potential armor rock and gravel sources for construction of the breakwater and upland facilities. Several potential sources of onshore and offshore gravel sources were identified. However, no rock suitable for use as armor material on the breakwater was found.

A meeting was held at Candle with the owner/operator of the Candle Gold Mine in order to ascertain the quantity, quality, and availability of tailings at the Candle Mine. According to the owner, as much as 3 million cubic yards of tailings may be available for use as fill. Our observation of a small amount of the tailings suggest that the material may be suitable if an economical means of hauling the material approximately 50 miles can be found.

Potential offshore gravel sources are scattered along the south end of Kotzebue Sound and along Baldwin Peninsula. A potential source identified by the DOT & PF for the Kotzebue to Chicago Creek road, and observed by our project geologists during the July field reconnaissance, is located near Cape Blossom. Other potential resource locations being investigated include the City of Kotzebue, Nimiuk Point, a variety of small knolls on Baldwin Peninsula, as well as offshore sources on Baldwin Peninsula.

A6 can be seen from the above discussion, acquisition of fill and rock which will be required for this project will be a complex task with the final arrangements potentially involving use of a number of sources. The Kotzebue to Chicago Creek road will strain the available supply even more.

C.1 PORT COSTS

Breakwater

The breakwater will be constructed with armor stone, Class B stone and core material. Preliminary costs and quantities of construction materials are described below. Costs are preliminary, but should be adequate for the level of accuracy required at this stage of the project. When test holes are drilled at potential material. sites, these costs can be considerably refined. The estimated upper limit of the cost for the breakwater is $90 million, allowing for contingencies in excess of following cost breakdowns. As mentioned earlier, alternate design methods and modified design criteria will be investigated during the following phase.

Since nearby sources of armor rock have not been found, cost estimates for armor rock are increased. It is probable that the cost of armor stone may reach $80 per cubic yard. Rock will probably be hauled from near Nome. Approximately 400,000 cubic yards of armor rock will be required. Class B stone might be obtained from the same quarry as the armor stone. There are no identified Class B material sources on Baldwin Peninsula. Transportation and hauling costs are less for Class B stone than for armor rock. It is probable that the cost for Class B stone will run around $50 per cubic yard. Approximately 200,000 cubic yards of Class B stone will be required.

The core material for the breakwater can probably be obtained on Baldwin Peninsual or on the south end of Kotzebue Sound. Some barge haul will probably be required. For preliminary estimating purposes, a cost of $15 per cubic yard will be used, based upon a haul from the Candle area. Approximately 700,000 cubic yards of core material will be required.

The dock structure is estimated to require 1500 tons of steel sheetpiling at $5000/ton, and 4000 c.y. of concrete at $500/ton. Both prices include placement of materials.

<u>Port Uplands Costs</u>

The cross-section for the port site has not been determined. It is important, however, that the permafrost not be allowed to melt. An insulated embankment covering the area that would probably develop to meet immediate port needs would require approximately 200,000 cubic yards of fill, based on an immediate development of 20 acres. Insulated gravel fill is estimated to cost about $15 per cubic yard, bringing the cost of site improvements to approximately $3 million.

Utilities

Provision of water, sewer, electricity, communication, and other utilities at the port is estimated to cost approximately $2 million.

Buildings and Other Facilities

Approximately $2 million will be required for construction of port administration buildings, maintenance buildings and other structures. This includes $1 million for a fuel storage and distribution system.

Total Port Cost

Initial development of the Cape Blossom port could cost up to $100 million, allowing $90 million for the causeway and $10 million for uplands and infrastructure.

c.2 AIRPORT RELOCATION COSTS

The airport envisioned for this project is a single 6,500 foot paved strip. Paving could be deferred until a later date, but should be considered as part of the airport cost. In addition, a small terminal facility should be provided. Utilities from the port could be extended to the airport, thereby greatly reducing utilities costs. The runway and apron is estimated to cost approximately $10 million, and paving will cost an additional $5 million dollars. Extension of utilities to the site would cost approximately $1 million, and construction of a small terminal and other facilities will cost approximately $2 million. Included within other facilities is a waterline, sewer, electricity and communications. The facility costs assume that a nearby deepdraft port has been developed. The preliminary estimate for an industrial type airport. is approximately $20 million.

APPENDIX D
PORT DESIGN CRITERIA

APPENDIX D PORT DESIGN CRITERIA

This section quantifies the physical parameters used in the structural design of the various members and components that make up the causeway and dock structures. These include material strengths, design loads, soil properties, and other physical factors.

D.1 MATERIALS.

The following material strengths were used in design:

Concrete	
Cast in Place	fc'= 3,000–4,000 psi
Precast	
Caissons (115–150 pcf)	fc'= 5,000–7,000 psi depending on scheme
Elevated Causeway Girders, Tees	fc'= 7,000 psi @ 28 days da fc'= 5,000 psi @ Release
Reinforcing Steel	Grade 60
Prestressing Steel	fy= 270 ksi
Structural Steel	
Sheet Piling, Rolled Shapes, Plates	fy= 36 ksi
Steel Pipe	fy= 42 ksi
Elevated Causeway Girders	fy= 50 ksi

Soil Bearing

See discussion under D.3, this appendix.

D.2 LOADS.

All structures and individual members were analyzed and designed to safely resist the maximum expected loads and the critical combinations of loads.

Weights of all structural materials and any fill or ballast were considered in the design.

A minimum uniform live load of 1,000 psf due to cargo, materials, or equipment was considered in the design of the docking facilities and earth fill causeway. These structures were also designed for standard AASHTO HS20-44 truck loads and for a 100 ton capacity mechanical crane.

Loadings on the elevated causeway are also discussed in Section C of the main report.

Wave analysis was based on a significant wave height of 15.2 feet with a period of 9 seconds for 50 year recurrent winds. Wave heights and forces were designed using second order wave theory. Because wave heights and forces on a structure depend on wave behavior, each situation was analyzed to determine whether the wave was breaking or non-breaking. Breaking waves result in significantly larger wave forces.

Wave behavior depends on the size of the design wave, depth of water, slope and roughness of the bottom, and slope of the structure's wave side face. Wave heights and forces on the structure were calculated from standard formulas and charts in the U.S. Army Corps of Engineers Coastal Research Center's "Shore Protection Manual".

Ice forces on the structures can be generated by several means and can act on the structures in different directions.

Vertical forces can be caused by ice accretion from snow and freezing of spray, weight at low tide of ice frozen to structural elements, buoyant uplift at high tide of ice masses frozen to structural elements, and the vertical component of ice sheet bending failure.

Because of the relatively larger dead weights of the dock caissons and earth fill causeway, these structures would be able to resist the vertical ice and snow loads.
Ice and snow weights on'the elevated causeway are discussed in Section D.5 of this Appendix.

Horizontal forces can be caused by crushing ice failure of laterally moving floating ice sheets, bending ice failure of laterally moving floating ice sheets, impact of floating **ice** masses, and jamming of rubble between structural framing members.

Horizontal ice forces may control the design of a structure and an analysis of forces is required. Crushing failure of **ice** represents an upper bound on ice forces and is a conservative design choice because ice compressive strength is normally several times its flexural or tensile strength. Uniform ice with regard to strength and continuity is assumed, which is also conservative. The crushing strength Of ice is about 400 psi.

Because of the flexibility of an ice field, pressures from piling up of wind driven ice rubble on a structure are probably not as great as those of a solid ice sheet in a confined area.

Because of its geographical location, Kotzebue Sound is not subjected to multiyear floes. Based on a 2 foot ice sheet, a horizontal force of 110 kips per linear foot of contact width at mean-lower-low water level was used.

Kotzebue Sound is located within Seismic Zone I, according to the Seismic Risk Map of the Uniform Building Code. This represents an area of minor potential damage with a low numerical coefficient for equivalent static force. Other seismic information is included in Part B of this report. Seismic forces are deemed not to have an impact on the dock or causeway structures.

Wind pressures for a recommended 100 year velocity of 82 mph were compared with other design forces. Because of the large ice and wave forces considered, wind forces are negligible for the design of the causeway piers and berthing facilities.

Wind forces would influence the causeway superstructures connection details, as the deck units would act compositely to resist lateral loads. Detailed design of these connections is beyond the scope of this study.

D.3 SOIL PROPERTIES.

Because detailed soils information for the proposed Cape Blossum Site was unavailable, soil supported structures were designed using conservative assumptions. These assumptions provided sufficient representative soil properties to determine structural adequacy for relative comparisons between schemes.

An angle of internal friction of 21" was used for unconsolidated, undrained, loose, silty sand. The soil bearing was limited to 3 ksf.

Variations in actual soil properties were assumed to affect all schemes similarly. Therefore, deviations from assumed valves did not affect rankings of the preferred candidate schemes.

A detailed soils investigation should be carried out prior to the final detailed design of the dock and causeway structures.

D.4 BUOYANCY OF FLOATING COMPONENTS.

Structural components of certain causeway pier and docking facility structures were designed to be floatable. These components would be manufactured in a graving yard and towed to the site or transported on a submersible barge and floated into place at the site. These floatable components, which are subject to overturning forces generated by waves, wind, and towing, were checked for stability against overturning and were designed for structural strength to resist these forces. They were also proportioned so their draft would not exceed that available in the positioning area.

D.5 STRUCTURAL CAUSEWAY.

The causeway superstructure was designed according to the Standard Specifications for Highway Bridges, 12th edition, adopted by The American Association of State Highway and Transportation Officials (1977).

The causeway superstructure was designed to support the maximum expected loads and the most critical reasonable combination of loads.

The weight of all structural members was considered in the design. In addition a future wearing surface weight of 60 psf was included.

The causeway superstructure wa5 designed to support the Standard AASHTO HS20-44 truck load. This design loading will accommodate standard truck and semi-trailer combinations that are legal on pulic roads.

The AASHTO HS20-44 loading consists of the most critical loading situation of either truck loading or lane loading.

Truck loading represents the maximum 3 axle combination truck and semi-trailer. This loading consists of a 8 kip axle load and a 32 kip axle load spaced at 14 feet, and an additional 32 kip axle load spaced at 14 to 30 feet from the first 32 kip axle load, Lane Loading represents a truck train with a single maximum axle load, This loading consists of a uniform load of 640 lb per linear foot of load lane and a single concentrated load of 18,000 lb for moment and 26,000 lb for shear. Axle loads are applied at those locations that produce the most critical loading. Both truck loading and lane loading are applied in a 12 foot traffic lane. Loads were increased for impact to account for dynamic, vibratory, and impact effects of moving vehicles.

Ice accretion from freezing of spray can considerably increase the vertical loads on the causeway superstructure. A 2 foot maximum thickness of ice was assumed over the causeway span. This resulted in a uniform loading of 112 psf.

A 100 year snow load of 95 psf was considered. Because the value for ice loading was greater, the snow load did not control.

A mechanical crawler-type crane would be used on the dock to offload cargo. The crane would be periodically transported across the causeway to the onshore port or to Kotzebue and the causeway superstructure must be adequate to support the expected shipping weight of the crane or its components.

The present crane at Kotzebue has a rated capacity of 100 tons. For designing the causeway superstructure, a crane with a similar capacity was assumed. A 100 ton capacity crawler crane has a working weight of approximately 180,000 - 210,000 lb. Because of variations in crawler widths among crane manufacturers, it must be assumed that a crane could be positioned with each crawler supported by a single girder; each girder would therefore support one-half of the crane weight.' A girder design based on a total crane weight of 210 kips would result in girder sizes significantly larger than that required to support the other design loads. Removing the crane counterweights would reduce the crane's weight by approximately 80 kips, and removing the crane boom or comparable weights would reduce the total weight by another 10 kips. The crane load was therefore assumed to be a total of 120 kips, to be supported on 2 crawlers or other supports with a minimum overall length of 20 feet.

Causeway sections were analyzed and designed for the controlling combinations of loading that could occur. Criteria used to determine structural adequacy were stresses resulting from design loads, ultimate strengths for critical loads, and deflections due to service loads.

All girders were analyzed as simple span members rather than continuous members. Continuous members would reduce mid-span stresses from superimposed loads, but would require special construction details at girder ends. Differential settlement of adjacent support structures would create additional forces and stresses in continuous members. Accurate positioning in the placement of causeway support structures would be difficult to achieve. Horizontal misplacement of superstructure supports would be likely to occur during sinking of floating caissons, and vertical members may not be perfectly plumb. Precast continuous members would be quite sensitive to these variations in support locations.

Simple span members, in contrast, would be able to accomodate both vertical and horizontal differential movements of the support structures and would be more adaptable to larger construction tolerances.

APPENDIX E
AIRPORT DESIGN CRITERIA

APPENDIX E   AIRPORT DESIGN CRITERIA

General transport airports must conform to certain dimensional standards for wiaths and separations. The following summarizes dimensions for a general transport airport meeting Precision Instrument Runway (PIR) Standards, as prescrioea oy FAA Advisory Circular AC 150/5300 - GA, Figure 1:

Item	Dimension Standard
Runway Length	As required by tne critical airplane.
Width	
- Runway	100'
- Runway Safety Area	150'
- Taxiway	50'
- Taxiway Safety Area	110'
Runway Centerline to	
- Taxiway Centerline	400'
- Airplane Parking Area	675'
- Property/Building Restrictions Line	750'
Taxiway Centerline to	
- Parallel Taxiway Centerline	200'
- Fixed or Movable Obstacle	100'

Runway Length Determination

The runway length at general transport airports is based on the critical airplane to be using the airport. An analysis of the fleet mix at similar airports in Alaska shows the Lockheed Hercules (C-130) and the Boeing 737-200 to be the predominant airplanes in the transport category. These are the aircraft which are selected as the critical or design airplanes for runway length determination and other design considerations.

Factors developed by the FAA allow the results of flight test and operational data for aircraft to be compiled as performance tables that can be used to determine required runway lengths. For planning purposes, tne runway length has been selected on the basis of maximum allowable takeoff and landing weights, as defined for airport design.

Runway length requirements are computed for the Boeing 737-200, since this is the critical aircraft for runway length determination. Data required for the runway length selection process are shown on Table E.l. As shown in the table, the runway length is determined by takeoff rather than landing requirements. The increases in runway length needed to accommodate reduced flap settings, tnereby increasing carrying capacity, is not justified for a first stage development. Accordingly, tne shortest runway capable of handling the maximum allowable takeoff weight has been selected. With appropriate adjustment for gravel surfacings, wind, and runway gradiant, the recommended runway length is 6,400 feet.

RUNWAY LENGTH DETERMINATION[1] TABLE E-1

Design Conditions

Airplane: Boeing 727-200: JT ED-9 Engine

Mean Daily Maximum Temperature	60°F
Airport Elevation	25' MSL
Effective Airport Runway Gradient	0.5%

Landing Runway Length

Flap Setting[2]	Table[3]	Maximum Allowable Landing Weight (lbs)	Lanaing Runway Length
40"	29	103,000	5,400'
30"	30	103,000	5,800'
25"	31	103,000	6,500'

Takeoff Runway Length

Flap Setting	Table	Maximum Allowable Takeoff Weight (lbs)	Reference Factor	Takeoff Runway Length
15'	32	100,000	39.4	5,800'
5"	33	107,700	45.4	7,100'
1"	34	114,500	53.2	9,000'

Notes:

1. Runway lengths are rounded up to next 100 feet.
2. Flap settings presented are only ones authorized for certified operation, and no interpolation between settings is allowed.

3. Table numbers refer to those in Appendix 6 of FAA Advisory Circular AD 150/5325-4, CHG #10, "Runway Length Requirements for Airport Design."
4. A paved runway with zero wind and zero effective gradient is assumed: basic runway length must be increased by 10% for each 1% of effective runway gradient. An additional 2-1/28 is added to compensate for gravel surfacing and another 2% is added to compensate for wind. The design runway length is, therefore, increased a total of 10% to account for those factors, bringing the adjusted length (rounded to the next 100') to 6,400 feet.

It is anticipated that the Boeing 737-200 would be the principal aircraft utilizing the new airport. Based on FAA design criteria, as adjusted for conditions at'Cape Blossom, 6,400 feet of runway length would be needed.

Several airfields in the area that are capable of accommodating heavy multi-engine aircraft are owned and operated by private firms engaged in mineral and petroleum exploration, development, or production. These airfields have runways between 5,500 and 6,500 feet in length, surfaced with gravel or asphalt. A runway length of approximately 5,500 feet is capable of handling a Lockheed Hercules C-130.

However, future aircraft requirements should be consiaered in selecting an ultimate runway length, especially since selection of the ultimate runway length requires no immediate activity other than land acquisition. Longer runways would be needed for jets making long distance hauls; a potential application for large jets at Cape Blossom would include fish hauling to international markets.

A Boeing 707, a typical long-haul transporter, would require a basic runway length of about 7,500 feet. Adjusting for local conditions and rounding up to the next 500 feet would yield 8,500 feet as the ultimate length runway needed for a Boeing 707 at Cape Blossom.

Clearway annd Stopway Determinations

Turbojet engines have recently proven to be so reliable tnat engine failure on takeoff is very uncommon. As a result, clearways and stopways have been allowed to substitute for a portion of the hard runway. A stopway is a physical extension of a runway which can structurally handle a decelerating airplane during an aborted takeoff. A stopway has limited applicability at Cape Blossom, however, because sufficient full strength runway can be provided with minimal additional cost. The clearway is a geometric plane extending from each end of the runway with an upward slope not exceeding 1.25%. No object or terrain is permitted to extend above this plane, except for certain threshhold lights. It is advantageous to use a clearway because it serves to accommodate the takeoff distance requirements for that occasional operation requiring a greater takeoff distance than the critical aircraft for which the runway lengtn is designed. Although clearway lengths of up to 1,000 feet can be beneficial, a 500 foot clearway is deemed adequate at Cape Blossom. A clearway width of 500 feet will meet the requirements of most turbine powered airplanes expected to use the facility.

Runway and Taxiway Width Determinations

Runway widths for transport aircraft are based on the physical requirements of the aircraft, statistical data on elevations from runway centerline, and experience. The runway is the load-bearing area and varies from 50 feet at the smallest general aviation airports to 150 feet at the largest air carrier airports. Virtually all load applications occur in a control width of about 100 feet. A runway width of 100 feet is therefore used. Runway shoulders should be treated for a distance of 25 feet beyond the runway with bituminous material or dense turf to prevent erosion and to protect jet engines from ingestion of loose material as well as to provide a margin of safety for errant aircraft.

The parallel taxiway width can be less than that of the runway because the speed of the airplanes is much less. The need to protect the taxiing airplane from ingestion of foreign material into'the jet engines remains a consideration. k taxiway width of 50 feet is used for a general transport airport, with 25 foot wide shoulders and appropriate widened sections at curves. The low frequency of operations anticipated if the airport serves predominantly industrial support activities precludes the requirement for high speed turnoffs. Intial development may not require construction of the parallel taxiway.

Safety Areas and Imaginary Surface Design

Safety Areas: A cleared, graded, drained, and surfaced runway safety area is symmetrically located about the runway. The runway safety area will be designed to support snow removal, firefighting, and rescue equipment. It will also be capable of accommodating an occasional airplane without causing major damage to the aircraft. The required width for the runway safety area is 500 feet for precision instrument operation.

The taxiway safety area is located symmetrically about the taxiway and has a required width of 50 feet. The taxiway safety area will be treated to prevent erosion and the blowing of debris or loose material into a following airplane.

Runway and taxiway safety areas are shown on Figure E-1.

Imaginary Surfaces: Obstructions to air navigation are defined by imaginary surfaces. Imaginary surfaces for civil airports are shown on Figure E-2. The precision approach surfaces apply to the recommended Cape Blossom runway.

The primary surface is longitudinally centered about the runway and is 1,000 feet wide for a precision instrument runway and extends 200 feet beyond the end of .the runway. A transitional surface extends outward and upward at right angles to the runway centerline at a slope of 7 to 1 from the sides of the primary surface to a height of 150 feet above the runway,

The horizontal surface is 150 feet above the established airport elevation. According to topographical maps of the area and visual observation, there are no points within several miles of Cape Blossom which penetrate the horizontal surface.

The precision instrument approach slope is 50:1 for the inner 10,000 feet and 40:1 for an additional 40,000 feet.

Within the approach surface, a runway clear zone must be established. The airport owner must have positive control over development within the clear zone by long-term easements or by ownersnip in fee simple. This gives the owner long-term positive assurance that there will be no encroachment of airspace within the critical portions of the inner approach surface. For precision instrument runways the clear zone extends 2,500 feet, which is the distance required to reach a height of 50 feet for the 50:1 approach surface. Any structures which would penetrate the above discribed surfaces must be approved by filing a "Notice of Proposed Construction or Alteration" with the FAA.

Separations

The dimensional standards discussed earlier appear to be adequate for conceptual design purposes. Proper separations will be provided to allow convenient future upgrading to air carrier allocations, if required.

Surface Gradiant

Transverse gradiants for runways, taxiways and their associated safety areas are shown in Figure E-1. Runway longitudinal grade changes should be less than 1.7% and should conform to line of light criteria.

Line of Sight

An unobstructed line of sight should be provided along the length of the runway such that any two points 5 feet above the runway centerline will be mutually visible for the entire runway length,

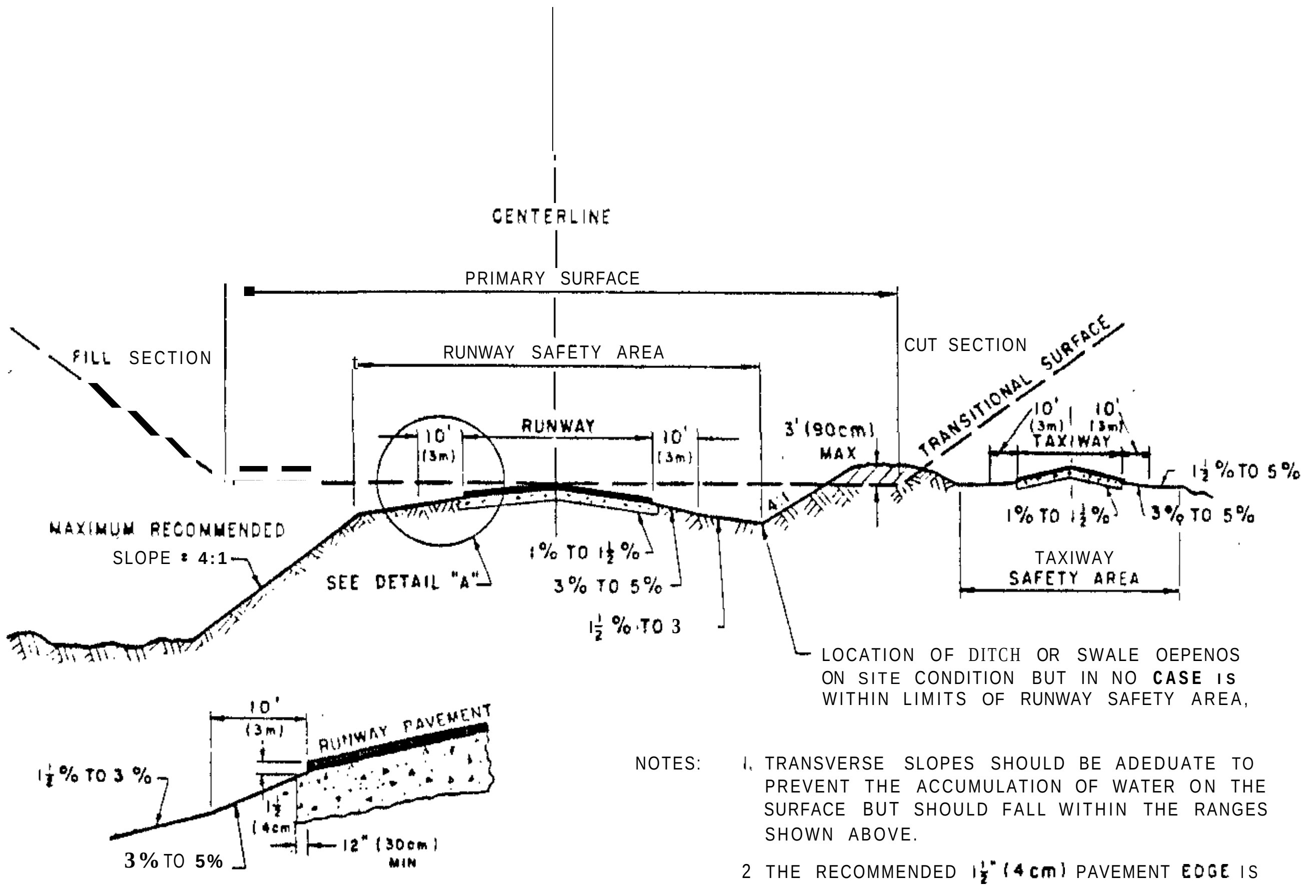
Crosswind Runway

There is insufficient projected demand to justify a crosswind runway during Stage 1 construction. The primary runway must, however, be located so that a crosswind runway of length equal to approximately 80% of the basic runway length can intersect the primary runway. The crosswind runway would have a non-precision instrument runway and general transport classification.

Apron

The apron will handle loading, unloading and servicing of aircraft and will also accommodate parked airplanes. An apron capable of servicing the anticipated peak-hour fleet mix and parking requirements would have an area of about 15 acres, with space reserved for future expansion. The proposed apron area could accommodate approximately four narrow bodied jets, which require approximately 1.25 acres each and forty small planes which require approximately 0.25 acres each.

TRANSVERSE GRADE LIMITATIONS FIGURE E-1



DETAIL "A"

'ORIGINAL GROUND ABOVE PRIMARY SURFACE ACCEPTABLE FOR STAGE CONSTRUCTION.

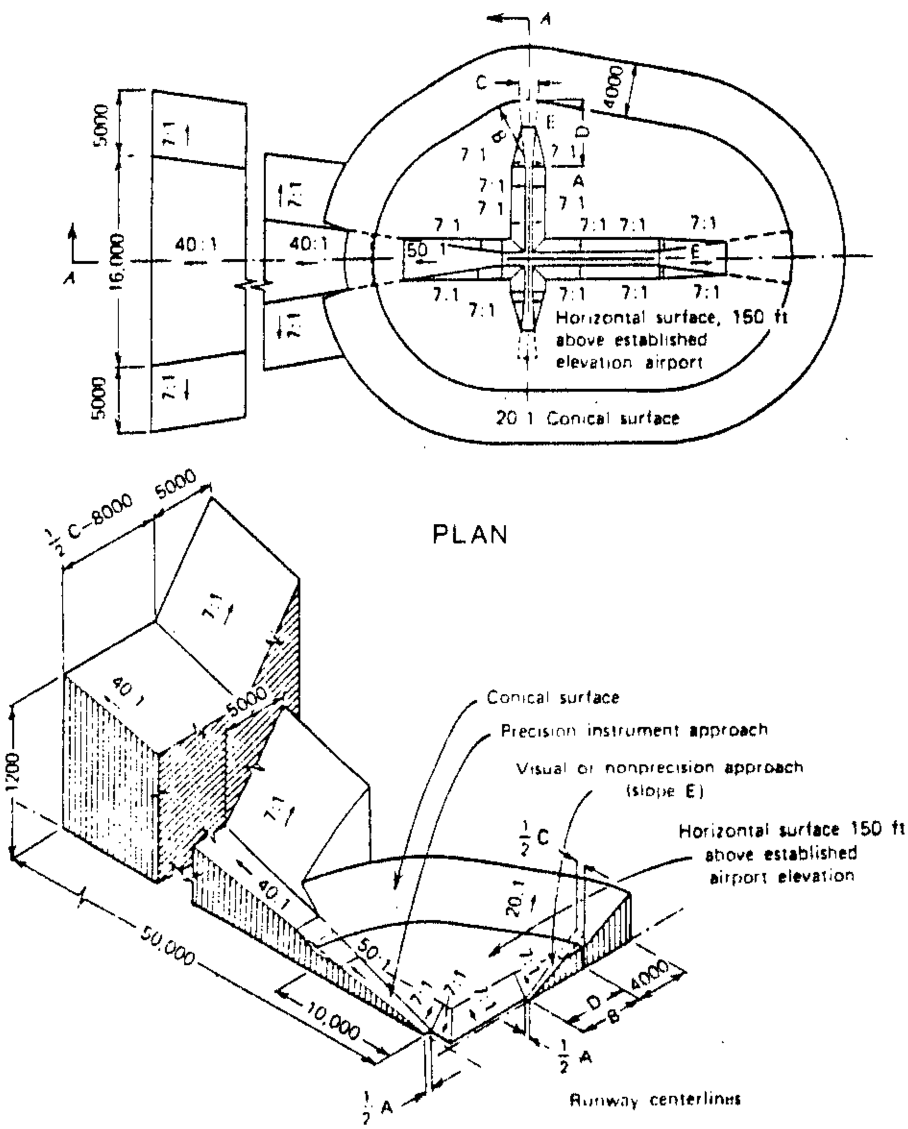
NOTES:

1. TRANSVERSE SLOPES SHOULD BE ADEDUATE TO PREVENT THE ACCUMULATION OF WATER ON THE SURFACE BUT SHOULD FALL WITHIN THE RANGES SHOWN ABOVE.
2. THE RECOMMENDED $1\frac{1}{2}$" (4 cm) PAVEMENT EDGE IS INTENDED TO BE USED BETWEEN PAVED AND UNPAVED SURFACES.
3. FOR THE FIRST 10' (3m) OF UNPAVED SURFACE IMMEDIATELY ADJACENT TO THE PAVED SURFACE IT IS DESIRABLE TO MAINTAIN A 5% SLOPE. THE MINIMUM REQUIRED SLOPE IS 3%.

NOTE - Source, FAA Advisory Circular AC 150/5300-6A, February 1981.

FAA IMAGINARY SURFACES FOR CIVIL AIRPORTS

FIGURE E-2



PLAN

SECTION

NOTE – Source, Norman Ashford, Airport Engineering. Wiley Interscience Publication. p. 105, 1979

APPENDIX F
WATER DEPTH PLOTS

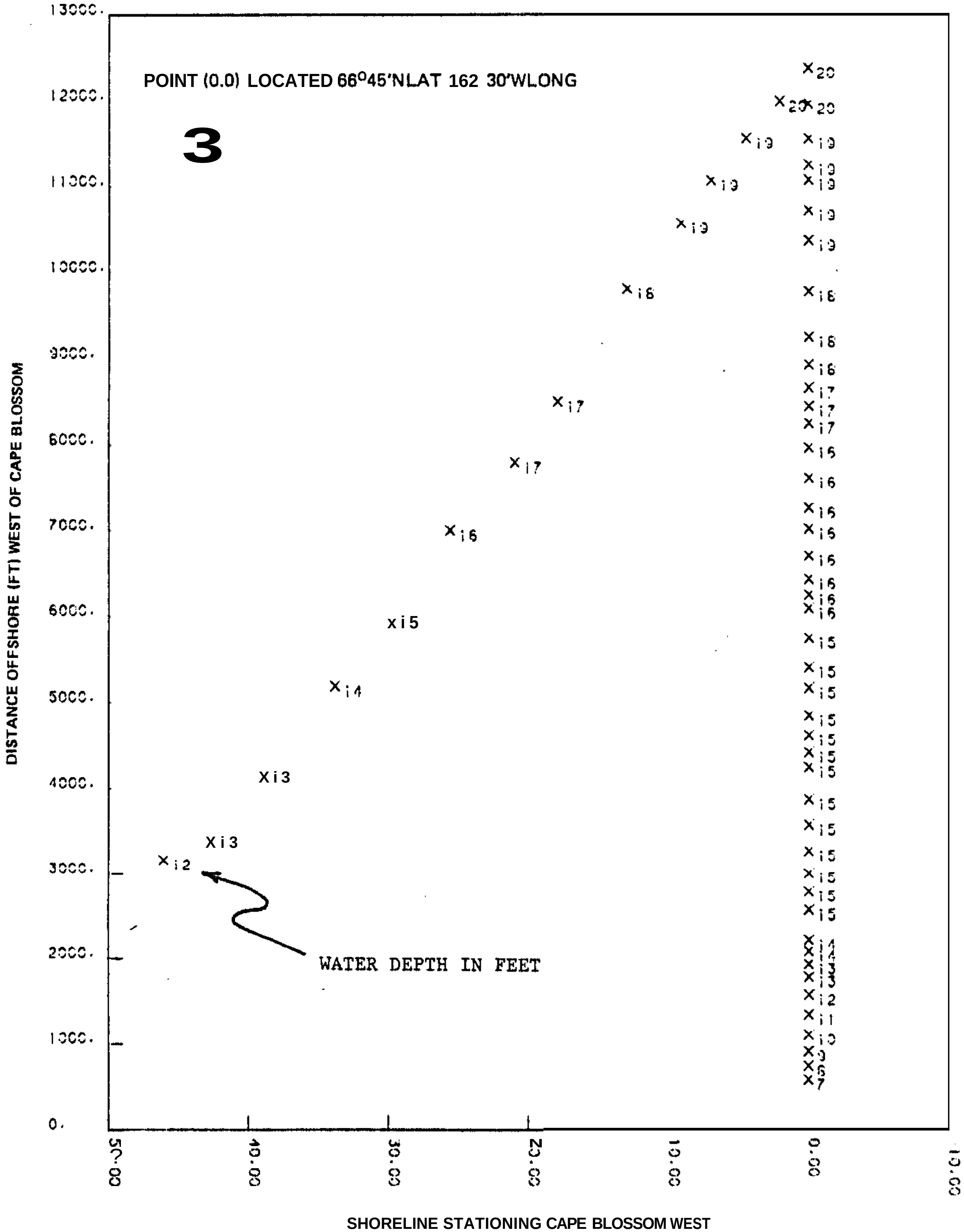


FIGURE F–1: PLOT OF BATHYMETRIC SURVEY LINE WEST OF CAPE BLOSSOM

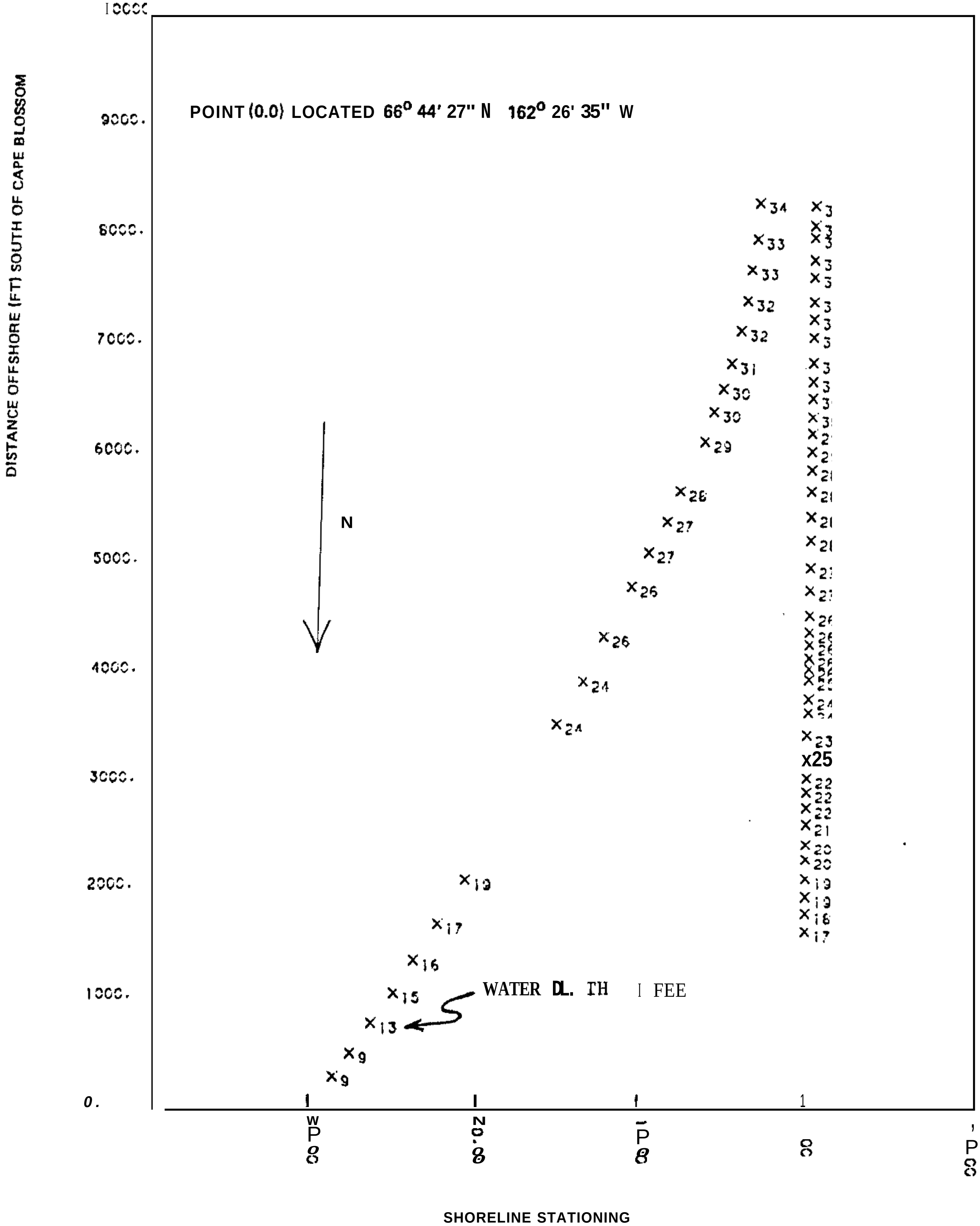


FIGURE F–2: PLOT OF BATHYMETRIC SURVEY LINE SOUTH OF CAPE BLOSSOM

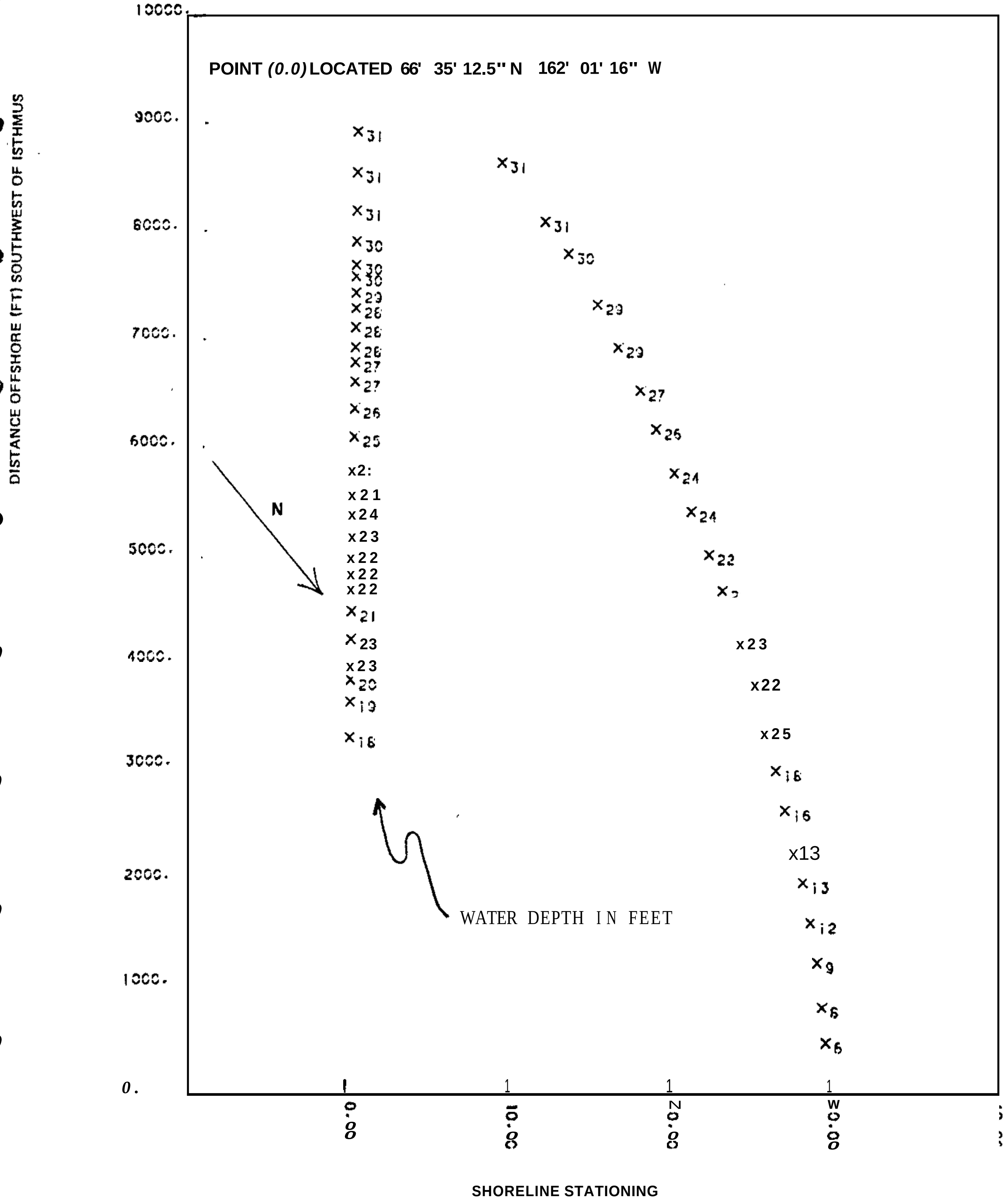


FIGURE F–3: PLOT OF BATHYMETRIC SURVEY LINE AT THE ISTHMUS

APPENDIX G

USE OF INDUSTRIAL DEVELOPMENT BONDS

APPENDIX G Use of Industrial Development Bonds

Section 103 (a)(1) of the Internal Revenue code of 1954, as amended (the "Code"), provides that interest on ooligations of states and their political subdivisions is not includable in the gross income of its recipients. Interest on .Obligations issued "on oenalf of" a state or political subdivision may also be exempt from taxation. Obligations issued by tne Alaska Industrial Development Authority ("AIDA") may qualify for tax exempt treatment.

Possible Entities for Issuing Tax Exempt Bonds in Alaska

Existing entities in the State of Alaska that could possibly issue tax exempt bonds for financing of the port facility at Kivalina include: (1) the Alaska Industrial Development Authority; (2) the cities of Kotzebue and Kivalina; and (3) business and industrial development corporations. Other entities, such as NANA regional borough, or a state-created special service area, could also be created under existing Alaska law and would be capable of issuing tax exempt bonds to finance the port. Each of these alternatives is discussed briefly below.

1. Alaska Industrial Devleopment Authority. The Alaska Industrial Development Authority, or "AIDA," is a state-created, quasi-governmental entitly authorized to issue tax exempt industrial development bonds for certain "projects" that will:

> "...promote, develop, and advance the general prosperity and economic welfare of the people of Alaska..., relieve problems of unemployment..., and create additional employment."

(AS 44.88.070)

Among the projects that may be financed by AIDA are:

> [(1)] a plant or facility used or intended for use in connection with... developing or utilizing a natural resource, or extracting,... transporting,... minerals, raw materials... commodities and materials, products or substances of any kind or nature, [and (2)] any plant or facility used or intended for use... in connection with air and water transportation.

Clearly then, the port facility at Kivalina is a type of project that might be considered by AIDA for financing.

AIDA has two exempt bond programs: the tax exempt revenue bond program ("revenue bonds"), and the tax exempt umbrella bond program ("umbrella bonds"). Revenue bonds are bonds secured solely by the revenue earned or expected to be earned by the particular project for which they are issued, by the credit of the developer applying for the financing, and/or by the guarantors of the applicant's credit. Umbrella bonds are issued for projects that will not be secured solely by the revenue from the project or by the applicant. Bonds issued by AIDA can have a maturity of not more than forty (40) years, and have a ceiling of Fifty Million dollars ($50,000,000) per project unless special approval of the Legislature is obtained.

Applications for revenue bond issues are never made directly by a developer to AIDA. Rather, the developer must apply for financing through certain approved financial institutions, called "originators," such as certain commercial banks. If an originator believes that a project may feasibly be financed by a revenue bond, the originator will submit various application materials to AIDA. Any application to

AIDA must contain information to assist AIDA to show that the following eligiblity criteria have been met: (1) that the project and its development will be economically advantageous to the state and the general public welfare and will contribute to the economic growth of the state; (2) that the project applicant is financially responsible; (3) that provision has been made in the project to meet increased demands upon public facilities that might result from the project: (4) that the project will provide employment in an amount reasonably related to the amount of the financing by AIDA considering the amount of investment per employee for comparable facilities; and (5) that the scope of the project is sufficient to provide a reasonable expectation of the benefit to the economy of the state.

The application for a loan under the umbrella loan program is very similar to an application for the revenue bond financing. Again, the project developer must first locate an originator, such as a commmercial bank, that is willing to be the primary lender on the project. An application is then submitted to AIDA by the originator.

Loans for construction of a new project may not exceed seventy-five percent (75%) of the appraised value of the project or one hundred percent (100%) of the cost of construction of the project, as certified by the applicant and approved by AIDA, whichever is less. Real property loans must be secured by a mortgage, which is a first lien on the real property in fee simple or in a leasehold estate. The term of the loan may not exeed twenty-five (25) years, or seventy-five percent (75%) of the estimated economic life of the project as determined by ADIA.

2. The Cities of Kotzebue and Kivalina. As cities of the second class, both Kotzebue and Kivalina are given broad, general powers under Alaska law to own, construct, finance, operate and lease to third parties port facilities. Among other things, these cities may (1) own, lease or sell land; (2) plan, plat and zone the waterfront; (3) promote and sponsor projects; (4) develop, construct and operate facilities; (5) issue bonds; (6) spend tax revenues for port purposes; and (7) join with other public or private entities to develop or finance projects such as port facilities.

None of the sites presently under consideration for the Kivalina Port are within the physical boundaries of either Kotzebue or Kivalina. Alaska law does allow a municipality, however, to acquire and hold, lease or sell property located outside its municipal boundaries for the purpose of attracting new industry. It is not clear, however, whether a city may issue bonds for financing improvements on such property.

If the cities cannot issue bonds for the port by simply acquiring ownership of the port site, another option would be for one of the cities to annex the port site into the municipality itself. By annexing the property, the city would be authorized to excercise all of its authority over the land, including the authority to issue bonds and to construct the port. Annexation may be accomplished relatively quickly and easily under Alaska law, in accordance with AS 29.68.110.

Small cities such as Kotzebue and Kivalina would normally encounter difficulties in selling their revenue and general obligation bonds in the market place, because of the unfamiliarity of investors with the cities. A way of alleviating this problem might be to sell the bonds to the Alaska

Municipal Bond Bank Authority (the "AMBBA"). The AMBBA was created by and is subject to the provisions of AS 44.85.005. Its purpose is to provide a market for bonds of municipalities that might otherwise encounter difficulties in borrowing funds for capital improvements such as ports.

If one of the cities acquires or annexes the port site, another state financing vehicle may become available. Under the Port Facilities Development Act, Kotzebue or Kivalina may be able to obtain a State grant for design and construction of the port. A less likely possibility is that the city could obtain a direct capital appropriation from the State Legislature for construction of the port. However, the State does not appear to have any clear policy about the type and amount of transportation infrastructure which it will provide to cities in the unorganized borough.

3. <u>Special Service Areas</u>. Under Article X of the Alaska Constitution, the Alaska Legislature may create special service areas within the unorganized borough. The Legislature could thus establish a special port service area which could be given the power to issue bonds for construction of the port facility.

However, the Alaska Constitution explicitly provides that a new service area may not be established if the service can be. provided by incorporation as a city or by annexation of the area into an existing city. It therefore seems relatively unlikely that a service area authorized to issue bonds could be created.

4. <u>NANA Regional Borough</u>. For some time, the NANA Regional Corporation, which is located in the unorganized borough and whose boundaries appear to encompass all of the proposed sites

for the Kivalina project, has considered organizing itself into a borough. Were it to do so, it would have powers similar to those of a municipality to own, construct, finance, operate and lease a port, including the power to issue tax exempt bonds.

However, officials with the State of Alaska Department of Community and Regional Affairs have indicated that any such "boroughization" will not be initiated, if at all, for at least three years.

5. <u>State Business and Industrial Development Corporations</u>. Alaska Statute Title 10, Chapter 10 provides for the creation of "business and industrial development corporations" or "BIDC's." BIDC's may be created for the purpose of "promoting, developing, and advancing the prosperity and economic welfare of the state." (AS 10.10.010). Some BIDC'S have already beer, formed. BIDC's are authorized to borrow money from their members, which may be persons, corporations, insurance companies, and financial institutions, and to issue bonds, make loans, and to otherwise invest in Alaska businesses. BIDC's are therefore another potential source of tax exempt bond financing that might be profitably investigated in connection with the financing of the port facility.

AIDA is presently the most immediate and likely source of tax exempt bond financing. However, if AIDA will not finance the port on satisfactory terms, the alternatives outlined above should be investigated in greater detail.

The Code also provides in Section 103(b)(1) that industrial development bonds shall not be treated as obligations described in Section 103(a)(1 , i.e., except in certain specified cases, the interest on industrial development bonds will be taxable. Section 103 b)(4)(D) provides, however, that Section 103(b)(1) shall not apply to industrial development bonds if substantially all the proceeds of the bonds are used to construct exempt facilities.

For interest on industrial development bonds to be exempt, the bonds must be issued not only to provide an exempt facility but must also meet other Code requirements including (1) that the bonds be issued "by or on behalf of" a state or political subdivision, Reg. § 1.103-1; (2) that the bonds not be held by a "substantial user" of the financed facilities, Reg. § 1.103-11; (3) that the bonds comply with the arbitrage rules specified at the time of the execution of a certificate at closing.

In addition there is the official action requirement, i.e., that the issuer takes an official action toward issuing the bonds prior to commencement of construction or acquisition of the project. This official action must evidence the issuer's present intent to issue obligations for a specific project and the issuer must have the legal authority to issue the obligations: however, this action need not establish a legal obligation to issue the bonds. The amount financable from bond proceeds is that amount paid or incurred after the official action is taken, regardless of when the construction first commenced. The reason for the official action requirement is the intention of the IRS to prevent the refinancing of facilities. Substantially all (90%) of the bond proceeds must be used to provide the exempt facility.

Section 103(b)(4)(D) exempt facilities include (1) airports, docks and wharves, (2) storage or training facilities directly related to such facilities, and (3) property "functionally related and subordinate" to such facilities. Regs. § 1.103-8(e). In addition, property "functionally related and subordinate" to the exempt facility may qualify, but only if it is a character and size commensurate with the character and size of the exempt facility. Regs. 1.103-8(a)(3).

Reg. § 1.103-8(a)(2) requires that the dock or wharf so financed must be for general public use. The public use test for docks and wharves requires that the facilities be either: (1) open to the general public or (2) open to use by common carriers or by charter carriers serving the general public or (3) part of a public port. The pertinent regulation is set forth below.

> To qualify under section 103(c)(4) and this section as an exempt facility, a facility must serve or be available on a regular basis for general public use, or be a part of a facility so used, as contrasted with similar types of facilities which are constructed for the exclusive use of a limited number of nonexempt persons in their trades or businesses. For example, a private dock or wharf owned by or leased, and serving only a single manufacturing plant would not qualify as a facility for general public use, but a hangar or repair facility at a municipal airport, or a dock or a wharf, would qualify even if it is owned by, or leased or permenently assigned to, a nonexempt person provided that such nonexempt person directly serves the general public, such as a common passenger carrier or freight carrier. Similarly, an airport owned or operated by a nonexempt person for general public use is a facility for public use, as is a dock or wharf which is a part of a public port.

Docks and wharves are described in Regs. 1.103-8(e)(2)(ii). However, in order to try to determine what qualifies as docks and wharves we need to examine the regulations and private letter rulings issued by the Internal Revenue Service. On previous occasions, docks and wharves were deemed to include equipment needed to receive and discharge cargo and passengers (e.g., cranes and conveyors), and related storage, handling, office and passenger areas. Grain elevators, silos, warehouses, and oil and gas storage tanks also qualified as related storage facilities. In order to meet the public use test that the facilities serve or be open to the general public or serve (by its ownership or lease) a common passenger or freight carrier, or be part of a public port (regardless of its ownership or restricted use), storage tanks at a public port qualified as did port facilities operated by a common carrier.

Offshore docking terminals for oil tankers and onshore salt dome temporary storage facilities did qualify where the facilities were owned by a nonexempt person subject to ICC regulation as a common carrier and were to be equally available to non-owner shippers. A drydock in a public port constructed for lease to a nonexempt person as a repair and maintenance facility for the general public qualified. A graving dock, outfitting berth, cranes, and lift dock that were adjacent to a shipyard in a public port were deemed to be primarily manufacturing facilities and therefore did not qualify. However, a repair facility available to other ship owners qualified under a separate letter ruling. Grain handling facilities constructed for a company in the terminal transshipping business qualified although it was not a public port because it served many users. Docks, wharves, and related' facilities for the loading and unloading of vessels and the storage of materials, all related to the cement manufacturing plant of a nonexempt person, qualified as part of a public port. Facilities for offloading and storage Of liquified natural gas for the benefit of nonexempt persons qualified as a dock within a public port, while offloading facilities in a public port qualified as did dock and storage facilities of common carriers.

It is understood that the facility would be located within the boundaries of the village of Kivalina, population approximately 250. The port and dock would be built primarily for the benefit of Cominco for its mining operations at Red Dog. Even if the port were leased to Cominco, the port still could qualify as an exempt facility under the Code if it met the public use test. It has been suggested that the port would be available to the general public, for loading and unloading of various types of vessels, depending on the location of the port and its depth. Utilization for offloading of goods transshipped from Kotzebue, or for transshipment of goods to Kotzebue as well as utilization by private vessels such as fishing boats, may all qualify the port development as an "exempt facility" under the Code.

APPENDIX H

BIBLIOGRAPHY

1. Alaska Dept. of Community and Regional Affairs, Community Map for Kotzebue, December, 1976.

2. Alaska State Dept. of Transportation and Public Facilities, Airport Layout Plan for Ralph Wien Memorial Airport, Division of Aviation, 1 map.

3. Alaska State Dept. of Transportation and Public Facilities, Land Occupancy for Ralph Wien Memorial Airport, Division of Aviation, 3 maps.

4. Alaska Dept. of Transportation and Public Facilities, Kotzebue to Chicago Creek Highway Project, Vols. I, II, and III, December 1981.

5. Alaska Dept. of Transportation and Public Facilities, Western and Arctic Alaska Transportation Study (Phase I), Draft Vol. III - Marine Transportation, 1980.

6. Alaska Dept. of Transportation and Public Facilities, Western and Arctic Alaska Transportation Study (Phase II), Chapters 1-8 and 10, December 1981.

7. Alaska Dept. of Transportation and Public Facilities, Western and Arctic Alaska Transportation Study (Phase III), unofficial, 1982.

8. Alaska Oil and Gas Conservation Commission, Personal Communication with W. Van Alen, 1982.

9. Applied Technology Council, Tentative Provisions for the Development of Seismic Regulations for Buildings, Applied Technology Council publication No. ATC 3-06, National Bureau of Standards publication No. 510, National Science Foundation publication No. 78-8, 1978.

10. Arctic Environmental Information and Data Center, University of Alaska, Kotzebue Cornunity Map and Description, for Alaska Department of Cornunity and Regional Affairs, December 1976.

11. Arctic Environmental Information and Data Center, University of Alaska, Storm Surge Climatology and Forecasting in Alaska, August 1981.

12. Arctic Lighterage Co., Natural Channel Location Map.

13. Bureau of Land Management, Aerial Photos, color infrared, Roll 2921, Frames 1949, 7959, 7961.

14. Bureau of Land Management, Cape Krusenstern National Monument, 1 Plat.

15. Cederstrom, D.J., Origin of a Salt-water Lens in Permafrost at Kotzebue, Alaska, Geol. Soc. America Bull., v. 72, p. 1427-1432, 1961.

16. Corps of Engineers, Alaska District, As Built Report for Shore Erosion Control Project (incomplete).

17. Corps of Engineers, Alaska District, Backup Data for Kotzebue Beach Erosion Demonstration Project.

18. Corps of Engineers, Alaska District, Backup Files for Flood Insurance Study.

19. Corps of Engineers, Alaska District, Kotzebue Beach Erosion, Section 103, September 15, 1973.

20. Corps of Engineers, Alaska District, Lost River Project, Final Environmental Impact Statement, March, 1976.

21. Corps of Engineers, Alaska District, Navigation Improvements Reconnaissance Report for Kotzebue, Alaska, June, 1981.

22. Dames and Moore, Assessment of Coal Resources of Northwest Alaska–Phase I, Vol. I, December, 1980.

23. Darbyshire and Associates, The Kotzebue Economy: Present and Future, February, 1982.

24. Darbyshire & Associates, NANA Regional Coastal Management Plan, Sept. 22, 1981 (incomplete).

25. Federal Aviation Administration, Advisory Circulars (several).

26. Federal Aviation Administration, Form 5010-1 for Ralph Wien Memorial Airport.

27. Federal Aviation Administration, Obstruction Chart for Ralph Wien Memorial Airport, 1 map.

28. Federal Aviation Administration, Real Estate Data for Kotzebue Airport, 2 maps, 1969.

29. Federal Emergency Management Agency, Flood Insurance Study (Preliminary) for City of Kotzebue, November 2'8, 1980.

30. Federal State Land Use Planning Commission, Transportation and Development of Alaska Natural Resources, March, 978.

31. Ferrians, O. J., Jr., Kachadoorian, R., and Greene, G.W., Permafrost and Related Engineering Problems in Alaska, U.S. Geological Survey Professional Paper 678, 1969.

32. Grybeck, D., Beikman, H.M., Brosge, W. P., Tailleur, I.L., and Mull, C.G., Geologic Map of the Brooks Range, Alaska, U.S. Geological Survey open File Report OF-77-166-B, 1977.

33. Hale, L.Z., Bibliography and Index of Information on the NANA Region, Arctic Environmental Information and Data Center, University of Alaska, 1979.

34. Hale, L.Z., The NANA Region Environment - A Summary of Available Iniormation, Arctic Environmental Information and Data Center, University of Alaska, 1979.

35. Hershey, O. H., "The Ancient Kobuk Glacier of Alaska", Jour. Geology, v. 17, p. 83-91, 1909.

36. Hopkins, D.M., Coastal Processes and Coastal Erosional Hazards to the Cape Krusenstern Archaeological Site, U.S. Geological Survey Open File Report OF-77-32, 1977.

37. International Conference of Building Officials, Uniform Building Code Standards, 1976 edition.

38. John Graham Company/Boeing Computer Services, Inc., Natural Hazards-in-the Alaska Environment, Processes and Effects, Joint Federal-State Land Use Planning Commission for Alaska.

39. Kelly, Pittelko, Fritz and Forssen, Feasibility Study for Industrial Park/Dock Facility, Kotzebue, Alaska, (Preliminary Draft), December, 1975.

40. Lawrence mil Ice G i ti in the Alaskan chi Sea.

41. Mauneluk Association, Inc., The NANA Region-Its. Resources and Development Potential, Report No. 221.

42. McCulloch, D.S., "Quaternary Geology of the Alaskan Shore of Chukchi Sea", Hopkins, D.M., ed., The Bering Land Bridge, Stanford, Stanford Univ. Press, pp. 91-120, 1967.

43. McCulloch, D.S., Taylor, J.S., and Rubin, M., "Stratigraphy, Non-marine Mollusks, and Radiometric Dates from Quaternary Deposits in the Kotzebue Sound Area, Western Alaska", Jour. Geology, v. 73, pp. 442-453, 1965.

44. Meyers, H. , A Historical Summary of Earthquake Epicenters In and Near Alaska, National Oceanic and Atmospheric Administration Technical Memorandum EDS NGSDC-1, 1976.

45. Patton, Jr., W.W., and Miller, T.P., Regional Geologic Map of the Selawik and Southeastern Baird Mountains Quadrangles, Alaska, U.S. Geolgical Survey Miscellaneous Geologic Investigations Map 1-530, 1968.

46. Pewe, T.L., Quaternary Geology of Alaska, U.S. Geological Survey Professional Paper 835, 1975.

47. Preston, J.E., Fibich, W.R., George, T.H. and Scorupl, P.C., Range Sites and Soils of the Kotzebue Sound Area, U.S. Soil Conservation Service.

40. Quadra Engineering, Inc., Contractor Series for City of Kotzebue. Prepared for City of Kotzebue and State of Alaska Department of Community and Regional Affairs, 3 maps with utility data for the Central Portion Kotzebue - (Electrical, Wastewater and Water), Undated.

49. Santa Fe Technical Services Company, Port of Valdez Market Penetration Study, Prepared for City of Valdez by Alaska Consultants, March, 1979.

50. U.S. Geological Survey, Engineering Geology Bearing on Harbor Site Selection along the Northwest Coast of Alaska from None to Point Barrow, open file report #173, 1958, (reviewed only).

51. U.S. Dept. of Commerce, Engineering Feasibility Study for an Industrial Park/Port Facility at Kotzebue, Alaska, Economic Development Administration, February 1977.

52. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Local Climatological Data, Kotzebue, 1980.

53. U.S. Department of Commerce, National Oceanic and Atmospheric Administration National Ocean Survey, Nautical Charts, Chart No. 16006.

54. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey, Sectional Aeronautical Chart for Nome, Scale 1:500,000.

55. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey, Tide Tables For West Coast of North and South America, 1982.

56. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey, U.S. Coast Pilot, Vol. 9, 10th Ed., 1981.

57. U.S. Department of the Interior, Bureau of Land Maintenance, Climatic Atlas of the Outer Continental Shelf Waters and Coastal Regions of Alaska, Volume III.

58. U.S. Department of the Interior, Geological Survey, City of Kotzebue, Aerial Photo, 1978.

59. U.S. Department of the Interior, Geological Survey, 15 Minute Series Topographic Maps, Scale 1:63,360, Kotzebue (D-l), Kotzebue (D-2), Katzebue (C-1), Noatak (A-l), Noatak (A-2), Noatak (A-3), Noatak (A-4), Noatak (B-4).

60. U.S. Department of the Interior, Geological Survey, Scale 1:250,000 Kotzebue, AK, Noatak, AK.

61. Woodward Clyde, Prudhoe Bay Waterflood Project Report, February, 1902.

62. Wahrhaftig, C., (1965), Physiographic Divisions of Alaska, U.S. Geological Survey Professional Paper 482.